ENGINEERING AND MINING JOURNAL

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FOUNDED 1866

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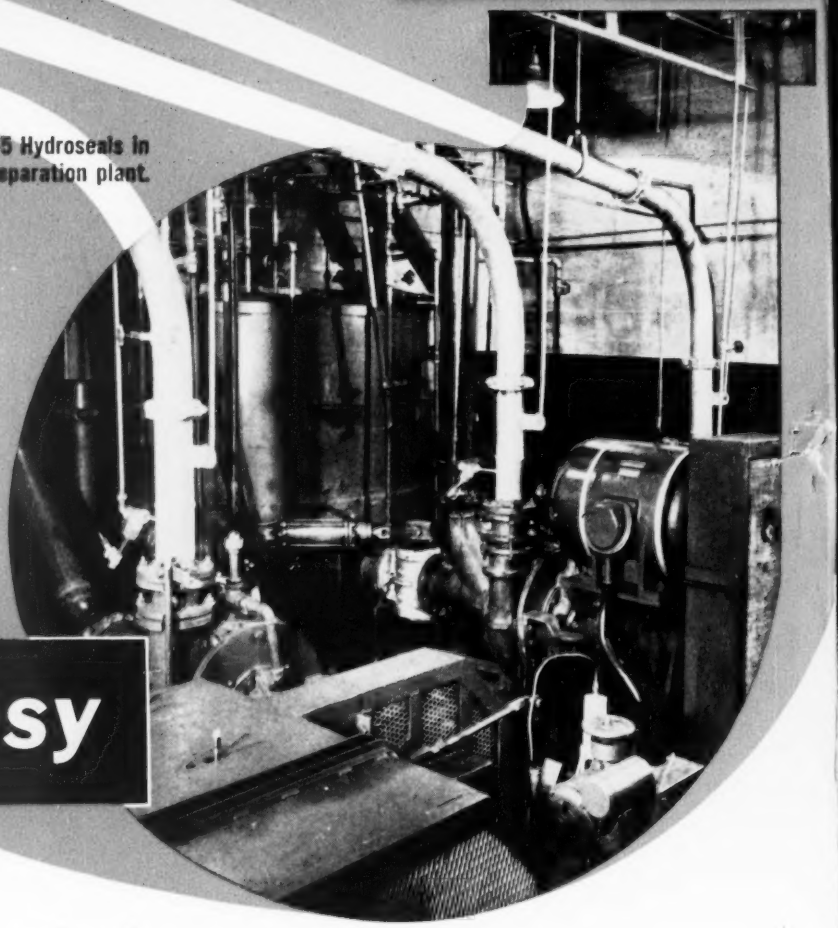
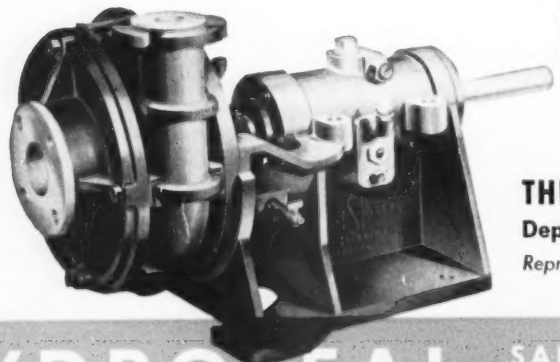


Three of the twelve B-3-5 Hydroseals in a large southern coal-preparation plant.

Washing COAL made easy

There's nothing like good steady pumps to make things easy for all hands in a coal-preparation plant. Take this big installation at Concord, Alabama, for instance. Day in, day out, they wash 1000 tons per hour with the help of twelve B-Frame Hydroseals, including stand-bys. And, from top management down to the operators who throw the switches, there's real enthusiasm for the economy, efficiency, and low maintenance of these pumps.

If you know someone who's been operating Hydroseals in his mill, get the good word from him. In the meantime, write for your copy of our latest catalog — it will tell you why he likes them.



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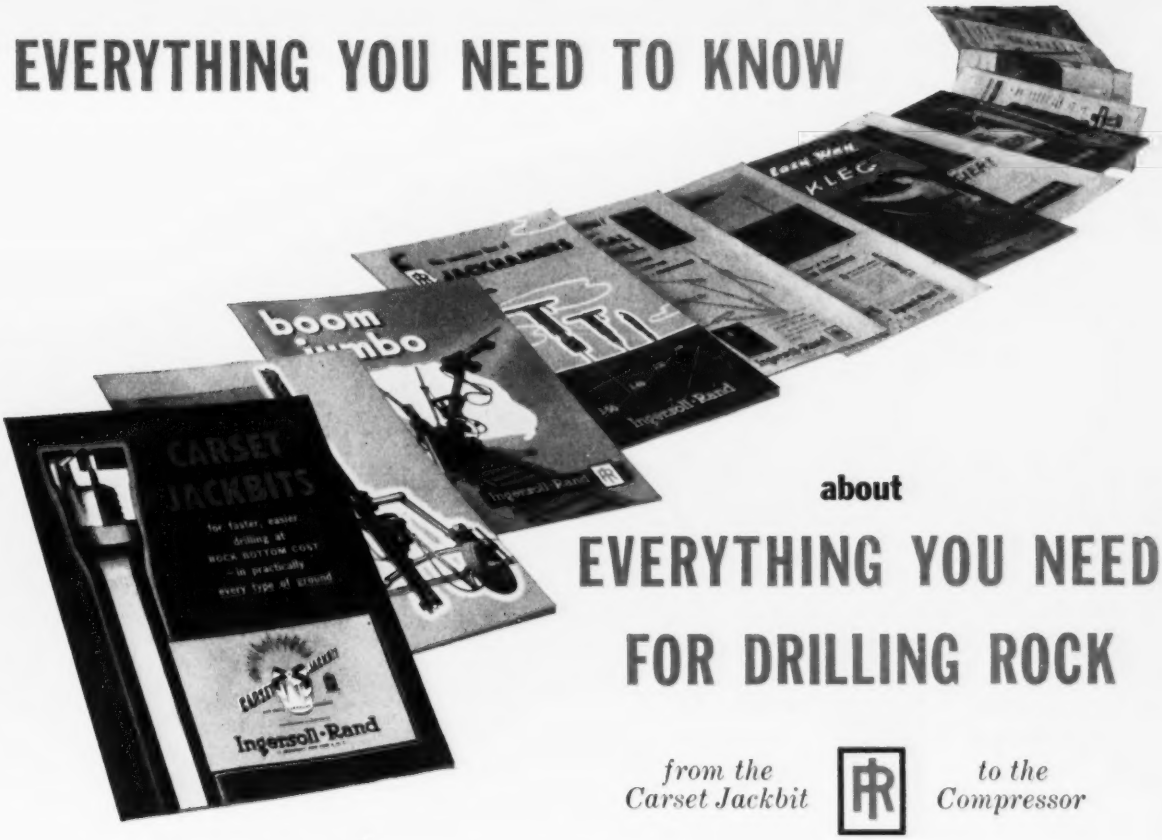
EVERYTHING YOU NEED TO KNOW



about

EVERYTHING YOU NEED FOR DRILLING ROCK

from the Carset Jackbit **IR** *to the Compressor*

No matter what your rock drilling problem is, you can be sure that Ingersoll-Rand can help you. The complete I-R line of rock drilling machinery is backed by 80 years of specialized experience—in designing, building, installing, operating and servicing everything from the bit all the way back to the compressor.

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19 million tons in 8 years B. F. Goodrich belts still in service

WHERE you have heavy impact, long centers, high lifts, there's a special belt for your installation — the B. F. Goodrich cord conveyor belt.

Cord belts stand more impact — Each lengthwise cord in a B. F. Goodrich cord belt is completely surrounded by rubber — no cross threads tie them together. Cords are free to "give" when impact occurs. The rubber takes the shock. B. F. Goodrich developed this cord belt years ago, and has since made a number of improvements that make it first choice for many really tough jobs. One such improvement is "balanced construction." Now the layers of individual cords are built into *both* the top and bottom of the belt to give even greater impact resistance.

Cord belts trough better — There being no crossweave in the cord plies, cords are free to flex. Belt conforms to idlers, pulleys. Spillage is reduced, troughing is natural and belt keeps centered on idlers, sustains less damage, requires less maintenance. Longer centers, higher lifts can be used.

Cord belts at work — Inside the housing shown here, a 3,000 ft. B. F. Goodrich beltroad handles iron ore in one of the largest mines on the Minnesota Iron Range. Installed in 1944, this series of cord belts have already handled over 19 million tons. Estimated life is 6 more years, 11 million more tons.

Cord belts for tough jobs — If your belts must take severe impact on loading, cutting and gouging at the loading chute, heavy loads with long centers and high lifts, you need B. F. Goodrich cord belts. Your local BFG distributor will show you how they can save you money, or write *The B. F. Goodrich Company, Industrial & General Products Division, Akron, O.* (Available in Canada)

Conveyor Belts BY
B.F.Goodrich
RUBBER FOR INDUSTRY

ENGINEERING AND MINING JOURNAL

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SCORE 100% if your answer is: "The oil that's best suited to the operating conditions."

Air compressors work under various conditions of humidity, temperature, pressure, etc. There is no one oil that will assure top performance under all of them. That is why there is a *complete line* of Texaco air compressor oils — so you can be sure of getting the right oil whatever your operating conditions, whatever the size or type of your compressors.

For your rock drills, use *Texaco Rock Drill Lubricant EP*. This "extreme pressure" lubricant offers the best protection against wear, guards against rust whether your drills are running or idle. Result — longer drill life and lower maintenance costs.

Let a Texaco Lubrication Engineer help you step up efficiency and cut maintenance costs. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

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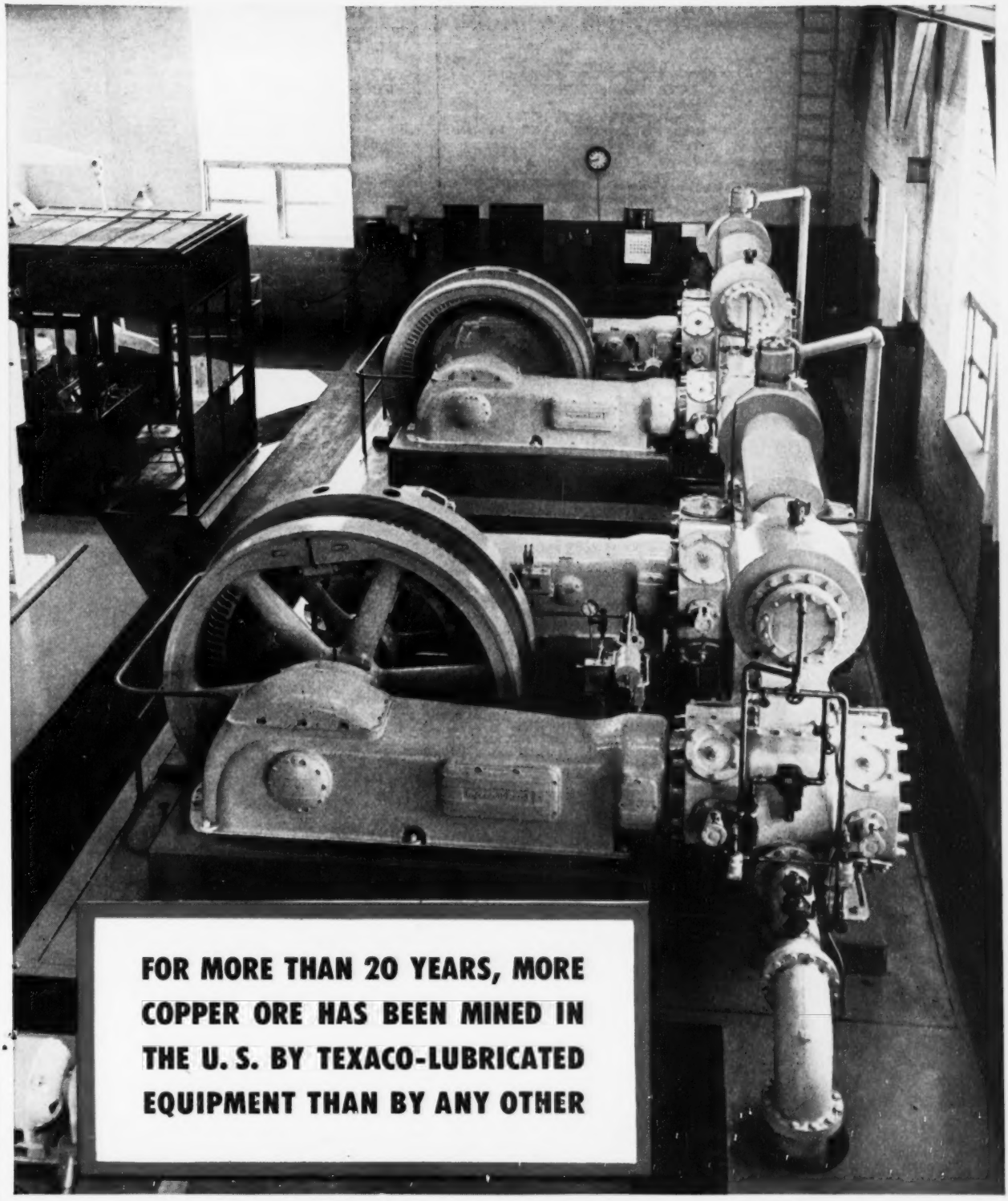
TUNE IN . . . TEXACO STAR THEATER starring MILTON BERLE, on television Tuesday nights. METROPOLITAN OPERA radio broadcasts Saturday afternoons.

TEXACO

TEXACO



Lubricants and Fuels

FOR THE MINING INDUSTRY

DRILLING *The Drillmobile has been leveled by its three hydraulic jacks. Operator at right is drilling a hole in a burn-wedge cut, while the operator at left is drilling a top relief hole.*

SLABBING *The jibs are swung back to line the machines for drilling outside slab holes.*

IN THE ROOF *The jibs can be raised and extended to drill a horizontal hole at a height of 15 feet.*

JOY . . . Since 1851—more than 100 Years of Engineering Leadership

DRILLMOBILES

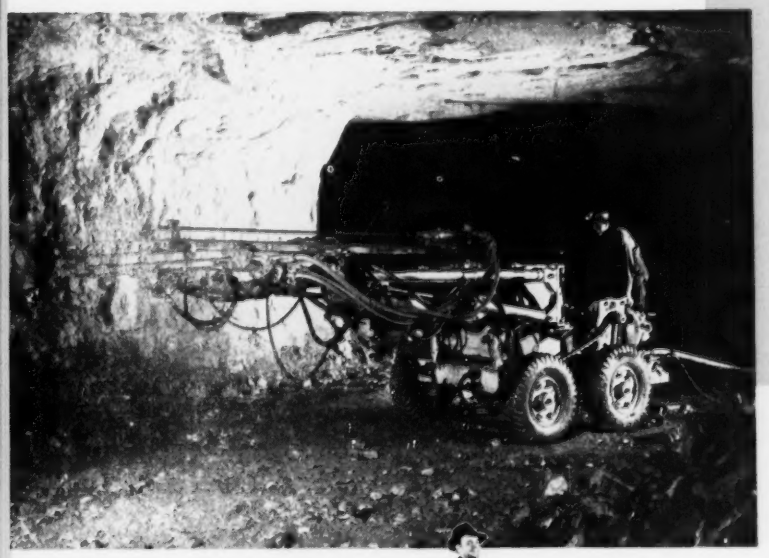
DO every job - SAVE everywhere!

The versatile, fast-tramming Joy DRILLMOBILE can mount one, two or three Hydro Drill Jibs. It has tractor-type steering so it can inch into shoe-tight drilling locations and worm around extremely short curves (it can actually turn in its own length).

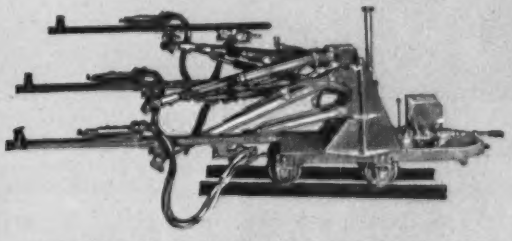
Hydraulic control of the Jibs is a cinch to eliminate hard labor, promote safety, and speed up drilling. Three hydraulic jacks keep the Drillmobile level and steady while drilling. You'll find hole positioning is easy and accurate. Then, too, there's no drill misalignment with a Drillmobile, so steel breakage is reduced . . . *fast!*

Drillmobiles come in two models—one for large drifts and stope work, and a "Junior" that'll do a man-sized job in small-section drift work. ● For tips on how to put your drilling on a paying basis, write for Bulletin 87-F. **Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

JOY HYDRO DRILL JIB *Air hydraulic control of all jib movements eliminates heavy lifting and permits more accurate hole spotting for more efficient use of powder and controlled breakage.*



TRAMMING *The Drillmobile travels under its own power. It can be easily converted to free wheeling for towing.*



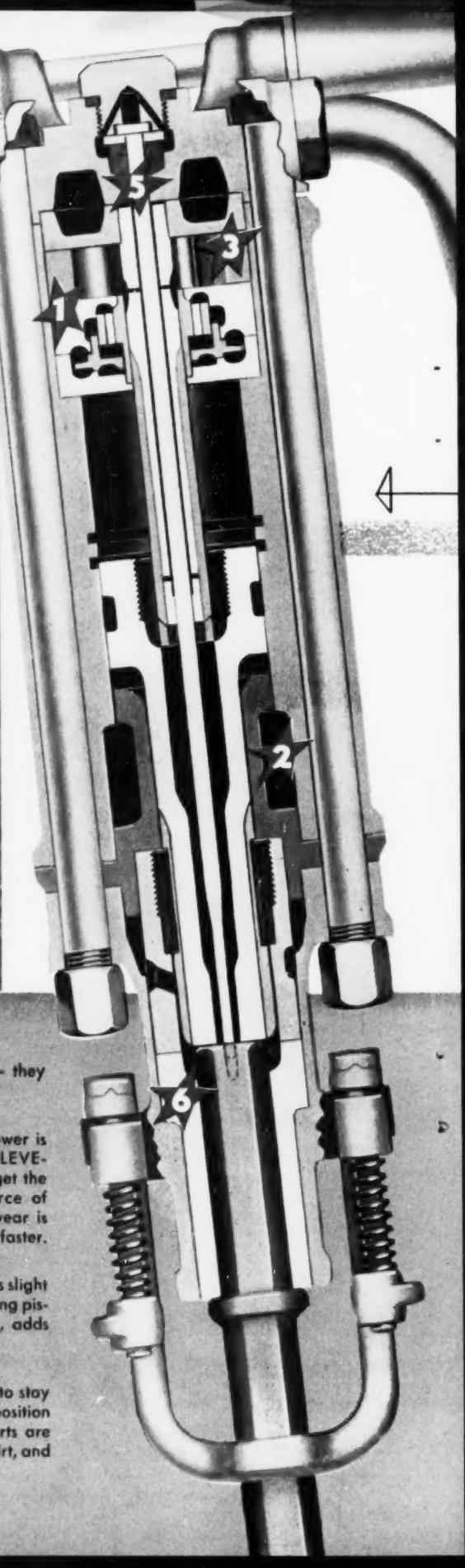
JOY TRIPLE JIB JUMBO *Track-mounted unit similar in many ways to the Drillmobile. Booms are quickly raised or lowered to any position. Truck is held rigid and solid by a 20-ton hydraulic jack.*

Consult a Joy Engineer

W&D M4392

JOY

WORLD'S LARGEST MANUFACTURER OF UNDERGROUND MINING EQUIPMENT



Design Features

1 End-seating valve is fast and positive in action. It meters the air efficiently — keeps air consumption down, provides powerful force of blow and strong rotation. Performance of valve is not affected by wear.

2 Positive lubrication system distributes oil throughout the machine and insures long life for all moving parts. Rifle bar is oiled at every stroke of piston. This prolongs the life of rifle nut and rifle bar at least 50%.

3 All Le Roi-CLEVELAND Sinkers are famous for strong, positive rotation. That's why they are at their best when the drilling's the toughest. Properly designed rotation parts—ratchet, pawls, rifle bar and rifle nut—plus efficient lubrication of these parts, give you this important drilling advantage.

4 Exhaust ports are large — they avoid freezing.

5 Plenty of hole-cleaning power is provided in all Le Roi-CLEVELAND Sinkers, so that you can get the most out of their powerful force of blow and strong rotation. Bit wear is reduced and drilling speeds are faster.

6 Floating-type chuck permits slight misalignment without binding piston. This reduces piston scoring, adds to life of the machine.

7 Throttle valve is designed to stay in any desired operating position from full-on to blowing. All parts are fully enclosed, protected from dirt, and generously lubricated.

Here's the "inside story"

of why Le Roi-CLEVELAND Sinkers drill more footage per shift, stay underground longer

THERE are things you *can't see*, behind Le Roi-CLEVELAND dependability—"hidden values," design details. But you know *they're there*—because that's why Le Roi-CLEVELAND Sinkers drill more feet of hole per shift . . . why they run at peak efficiency day in and day out . . . why they lower drilling costs on any job that requires a hand-held drill.

It's Le Roi-CLEVELAND *engineering* that gives you performance advantages that really pay off for you: Low air consumption. Easy handling. Strong rotation. High drilling speed.

Le Roi-CLEVELAND has a complete line of sinkers from 18 to 80 lbs. Your Le Roi representative can show you why you're money ahead with any one of them. See him soon.

Write for free Bulletin No. RD25.

CLEVELAND ROCK DRILL DIVISION
Le Roi Company
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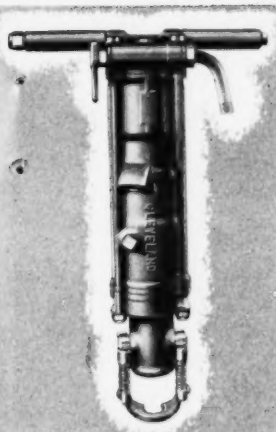
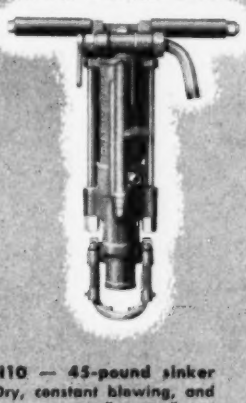


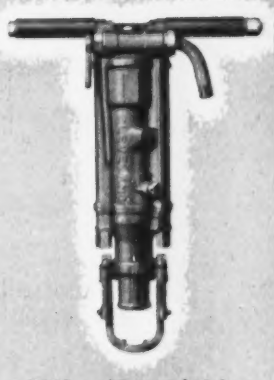
H23 — 83-pound sinker Dry and wet types. 1"x4¼" hex or quarter-octagon. 1¼" or 1⅛" lug shank. Designed for shaft sinking in hard rock or bad, faulting ground . . . general drilling with heavy steel in hard rock.



H10 — 45-pound sinker Dry, constant blowing, and wet types. ⅞" x 3¼" and 1" x 4¼" hex or quarter-octagon chucks. Wet automatic dust-control back-head, if desired.

H166 — 33-pound sinker Wet and dry types. ⅞" x 3¼" chuck. Recommended for hard coal. Also ideal for wet or dry drilling in shale, limestone, sandstone, etc.

H22 — 18-pound sinker Wet and dry types. ⅞" x 3¼" chuck. Recommended for: Drilling holes for trolley hanger bolts. Cleaning up roof. Clearing out rock falls. Brushing bottom. Drilling oversize pieces at grizzley. Cutting hitches.

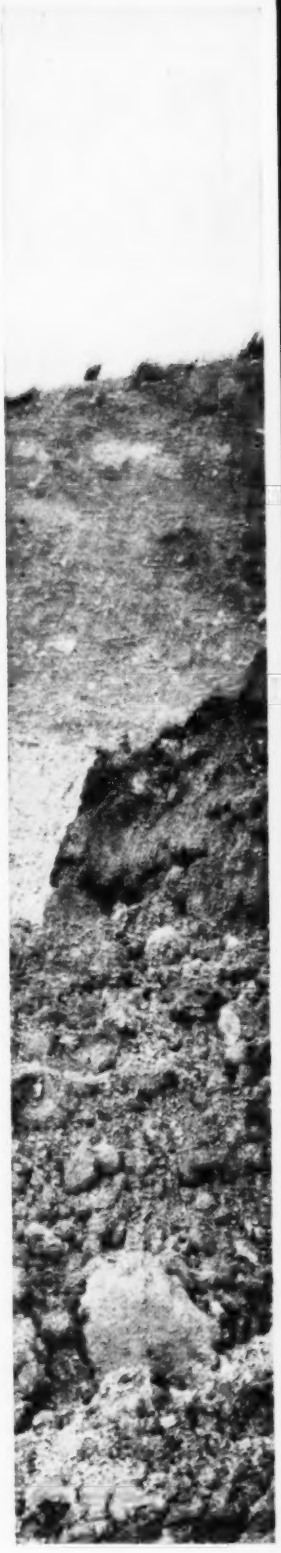


H111 — 55-pound sinker Dry, constant blowing, and wet types. 1" x 4¼" chuck (⅞" x 3¼" and popular sizes of quarter-octagon and lugged steel chucks also available.) Wet automatic dust-control back-head, if desired. Primarily designed for hard rock, but equally efficient in soft and medium formations.

Air-feed mountings up to 10' steel changes.

RD-52

WE say the Allis-Chalmers HD-20 is designed to OUTPRODUCE, built to OUTLAST



But anyone can make claims . . . That's why we invite you to get the facts firsthand from HD-20 owners. Just call your nearby Allis-Chalmers dealer. He'll be glad to tell you where you can see these great tractors at work . . . where you can talk to the men who own or operate them. When you do, experience tells us you'll hear about these big benefits:

Hydraulic torque converter drive gives the operator the equivalent of hundreds of gear ratios in two speed ranges — automatically selects the proper speed for maximum production. With hydraulic torque converter drive, you take full advantage of available horsepower . . . even at creeping speed. And cushioned protection means fewer repairs . . . longer life of tractor and auxiliary equipment.

In dozing, pushing or shovel work, there's nothing like the HD-20 for sheer productive power. Torque converter actually multiplies torque up to four and one-half times . . . develops tremendous drawbar pull to start the load smoothly, and automatically accelerates to highest speed conditions permit, in either high or low range.

New design, new performance. The HD-20 is built to take it— with such design advantages as all-steel welded construction . . . balanced weight and power . . . extra heavy main frame. Hydraulic control permits steering this 20-ton giant with only the touch of a finger.

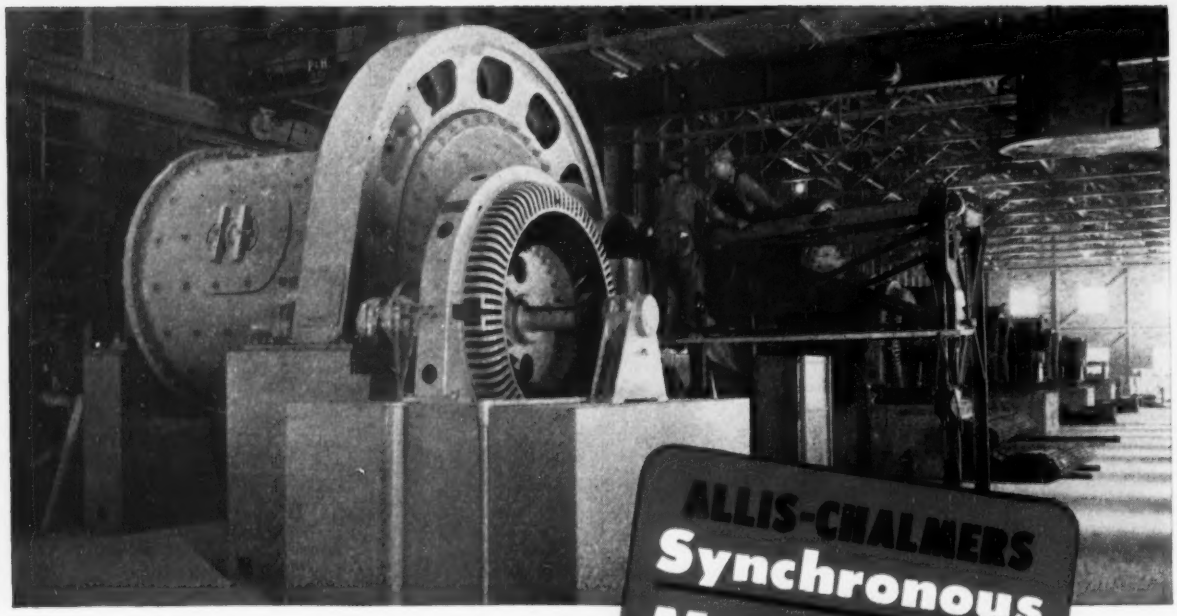
Easy to service, easy to maintain. 1,000-hour lubrication intervals for truck wheels, idlers, support rollers; no lubrication fittings under tractor. Major units are easily removed without disturbing adjacent parts; adjustments are simple.

See for yourself the many profit-making applications of the HD-20. Ask your Allis-Chalmers dealer to show you this outstanding tractor at work.

ALLIS-CHALMERS

TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

41,000 POUNDS
175 NET ENGINE HORSEPOWER
GM 2-CYCLE DIESEL ENGINE



Five Allis-Chalmers synchronous motors and 9 x 12 rod mills in new midwestern lead ore processing plant. Motors are rated 450 hp, 100% pf, 440 volts, 257 rpm.

Built for a Long Grind

Here are three reasons why Allis-Chalmers grinding mill motors help keep your mills grinding economically year after year:

Each motor is engineered for its job. A-C's half century of experience building electrical equipment *and* processing machinery assures torque and other operating characteristics tailored to the individual installation requirements.

Time-proved basic design features contribute to long life and trouble-free operation. These are described in Bulletin 05B7648.

Adequate manufacturing, inspection and testing facilities insure that each motor will be built exactly as specified.

For more information on motors that minimize maintenance and down-time, call in your A-C representative, or write for illustrated Bulletin 05B7648. Allis-Chalmers. Milwaukee 1, Wisconsin. A-3883

ALLIS-CHALMERS

IT'S THE ROCK JOBS

that prove a Shovel!

Any shovel can dig dirt! But, put it in rock! Get up on a Northwest if you know "operation". Get the feel of the controls. Feel that crowd take a-hold. The dipper goes right on through as the hoist takes it up — no "re-starts" are required here. It's a full load in one cut. Remember the Northwest Dual Independent Crowd utilizes force most other independent crowd shovels waste — force that puts greater effectiveness at the dipper lip for handling tougher digging and producing more output.

To Northwest digging power add the "Feather-Touch" Clutch Control which brings ease of operation without the complications of pumps, piping and compressors; the Cushion Clutch that eliminates shock overloads before the damage is done; Uniform Pressure Swing Clutches that cut spotting time by eliminating the jerks and grabs in swinging; Northwest simplicity of design that makes upkeep easy and reduces "down time"; and all the other Northwest advantages that make Northwest a *real* Rock Shovel.

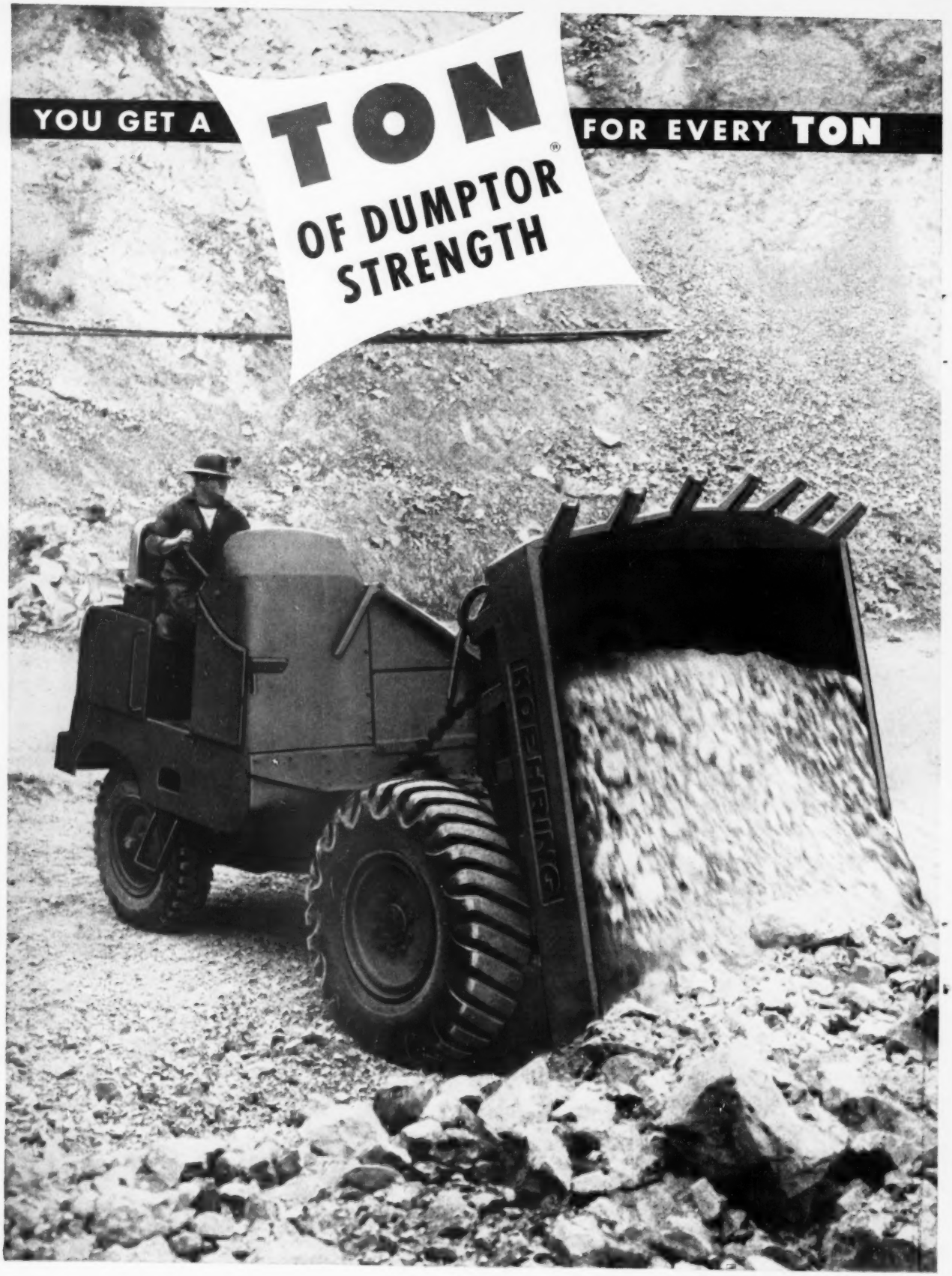
You can plan to have a Northwest. Now is the time to find out about Northwest design and operation. Why not talk it over with a Northwest man?

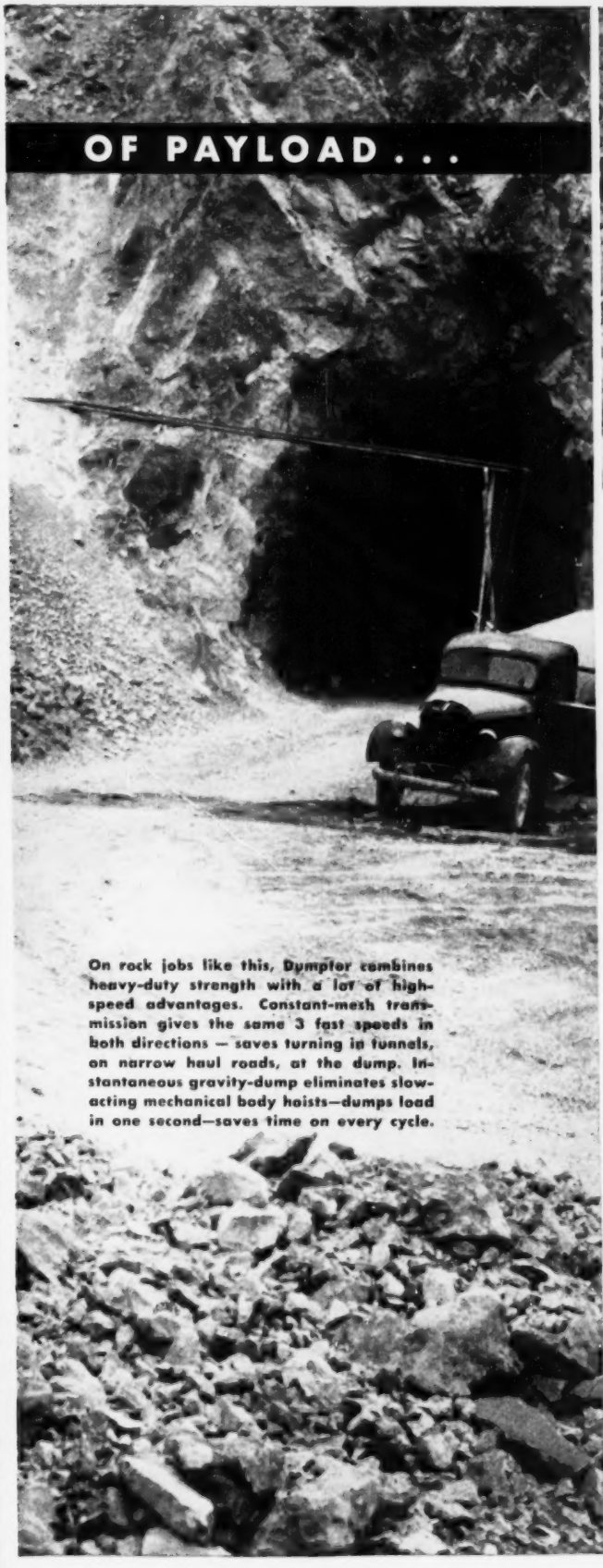
NORTHWEST ENGINEERING COMPANY
1509 Field Bldg., 135 South LaSalle Street, Chicago 3, Illinois

it's another NORTHWEST in ROCK!

Successful Contractors Stay Successful With Proved Equipment

SHOVELS • CRANES • DRAGLINES • PULLSHOVELS


YOU GET A TON FOR EVERY TON
OF DUMPTOR® STRENGTH
KOEHRING



OF PAYLOAD . . .

On rock jobs like this, Dumptor combines heavy-duty strength with a lot of high-speed advantages. Constant-mesh transmission gives the same 3 fast speeds in both directions — saves turning in tunnels, on narrow haul roads, at the dump. Instantaneous gravity-dump eliminates slow-acting mechanical body hoists—dumps load in one second—saves time on every cycle.

When you're loading ½ to 2½ yards of rock at a pass, your hauling units need plenty of strength to last. With Koehring heavy-duty Dumptor, there's more than a ton of net vehicle weight for every ton of payload capacity. Sides, ends and bottom of all-welded body are heavily-reinforced with 5 and 8" channel ribs. Double-strength multiple rib-reinforced bottom cushions shocks of rock loading. Stationary or free-swinging kick-out pan adds another ½" steel plate to Dumptor bottom for extra protection.

There's plenty of strength, too, in the Dumptor chassis to take the constant pounding of heavy loading and rough off-road hauling. Rigidly-trussed 8" ship channels make up the main frame. 4" heat treated alloy steel drive axles are protected by one-piece cast-steel housing. "I"-beam steering axle is cast alloy steel. There are no leaf springs — just one big, double-coil chassis spring on the steering axle — none on drive axle. Big drive tires eliminate the need for more springs — absorb loading and hauling shocks, save spring maintenance.

Even with all this heavy-duty construction, Koehring Dumptor has over 6 HP per ton of loaded weight — accelerates fast, pulls through soft ground and up grades with less shifting — climbs 24% grades fully loaded. See what these Dumptor advantages can mean in more work-time, less down time on your jobs. Call Koehring distributor for full details, or send for catalog.

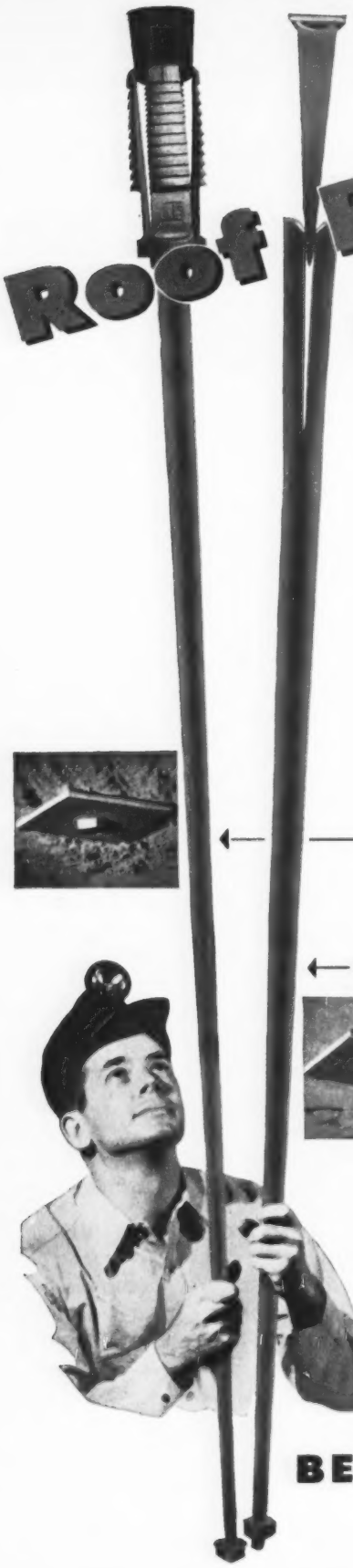
KOEHRING Company

Milwaukee 16, Wisconsin

Subsidiaries: JOHNSON · PARSONS · KWIK-MIX

K340

Roof Bolting... makes it a safer mine



Any mine becomes a safer mine when roof bolting is used, because roof-fall accidents are less likely to occur. Roof bolts consolidate layers of overlying strata into a thick, single-unit beam which is virtually impossible to dislodge.

Roof bolting also helps to increase production. It eliminates timber supports, provides large floor areas in which to operate mechanized equipment, and makes possible faster haulage, improved ventilation, and wider mine openings.

Improved safety, together with these better operating conditions, can be obtained by using either of the two Bethlehem Roof Bolts illustrated here. These bolts are made from new-billet steel in varied lengths. They can be used either vertically or at angles. Each has its proper application, depending on the kind of roof strata encountered. If you would like additional information, just get in touch with us at Bethlehem, Pa.

SQUARE HEAD ROOF BOLT. For 1⅛-in. hole. A ¾-in. rolled-thread bolt with pressed ears on shank to support expansion shell. When tightened, plug expands leaves of shell to provide holding-tension. Projections on leaves lock against sides of hole, prevent shell from turning during installation.

SLOTTED ROOF BOLT. For 1¼-in. hole. Forged slot takes wedge. Slot is automatically centered, forming equivalent of two half-rounds. Opposite end has 5 in. of 1-in. rolled threads. When inserted in hole, wedge penetrates slot, expanding ends of bolt. Truncated-cone point prevents thread damage. Has American Standard Regular Square Nut.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM MINE ROOF BOLTS

What kind of tires can your jobs afford ?

THE kind that are specifically designed for your types of jobs and equipment. The kind that only great practical experience can build. The kind that are built *sparing nothing* to bring you the greatest traction, the most rugged durability, the longest wear.

In short, the kind of tires that will keep your jobs rolling regardless—and save you time and money!

No truly cost-wise operator can afford a lesser tire—and that's why more tons, the world over, are hauled on Goodyears than on any other make!

It stands to reason that Goodyear, who has built more tires for more purposes than anyone else on earth—who has a vast practical experience matched by none, can help cut *your* operating costs, too!

Goodyear, Truck Tire Dept., Akron 16, Ohio.

FOR EACH JOB, THERE'S A COST-CUTTING GOODYEAR TIRE!

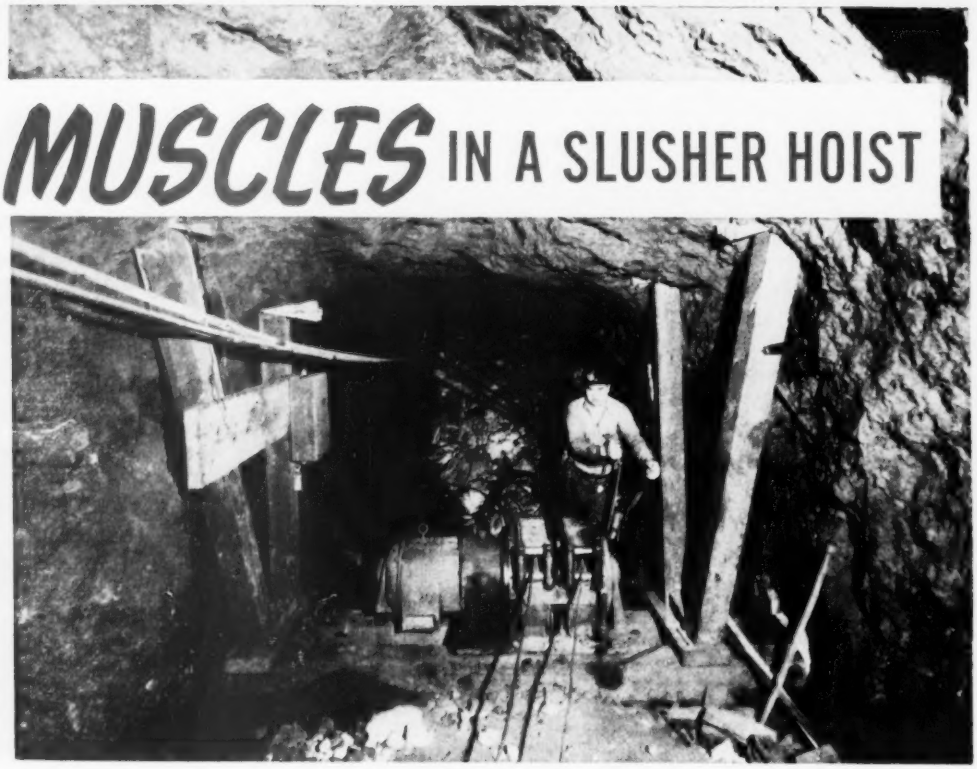
HARD ROCK LUG
For traction and toughness on tire-killing work.
HARD ROCK RIB
front-wheel work-mate to the Hard Rock Lug.
ROAD LUG
Best on-and-off roader. Runs smoother, cooler on highway — takes the rap in the rough!

Road Lug—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

GOODYEAR

We think you'll like "THE GREATEST STORY EVER TOLD" — every Sunday — ABC Radio Network — THE GOODYEAR TELEVISION PLAYHOUSE — every other Sunday — NBC TV Network

PUTTING *MUSCLES* IN A SLUSHER HOIST



Powering a slusher hoist is no job for a "pantywaist" cable.

Rockfalls, water, general mechanical and electrical abuse are normal events in the life of these cables. That's why you will find so many smart operators using Simplex-TIREX portable cables to bring dependable power to their slusher hoist. Simplex-TIREX Cables will operate dependably, even under the most adverse conditions, and they will do it for a surprisingly long time.

All Simplex-TIREX Cables are protected by a special cured-in-lead neoprene armor. This cured-in-lead process assures a smooth and tough outer jacket. The cable will not catch on obstructions. Thus it is easy to pull into place.

Simplex-TIREX Cables are no newcomer to the mining fields. They were developed for this service. They were the first cable to have a hard service rubber jacket. All other rubber-jacketed cables came after TIREX was developed. If you want dependable ore moving done, equip your slusher hoist with Simplex-TIREX Cable.

Simplex WIRES & CABLES

TIREX CORDS AND CABLES *are made only by the*

SIMPLEX WIRE & CABLE CO., 79 Sidney Street, Cambridge 39, Massachusetts

ENGINEERING REPORTS:

NEW TECHNIQUE OF COBALT FLOTATION was worked out in a pilot plant at Calera's Cobalt, Idaho installation to mill ore assaying 0.70 per cent cobalt. Reliability of the mill operation is promoted by the G-E engineered electrical system.

Calera will concentrate 1000 tons per day to ease cobalt shortage

Output kept continuous at new mine and mill by G-E engineered electrical layout

Soaring military demands for scarce cobalt—vital metal used in jet engines, armor plate, shells, and other weapons—will be met in 1953 with the help of the Calera Mining Company's new mine and mill at Cobalt, Idaho.

To keep the concentrator operating continuously, with fewest possible outages, this Howe Sound subsidiary turned to General Electric during the planning stage for help in engineering the electrical system. G-E application engineers designed—as a co-ordinated unit—the electrical layout for the mine, the mill, and the new town of Cobalt.

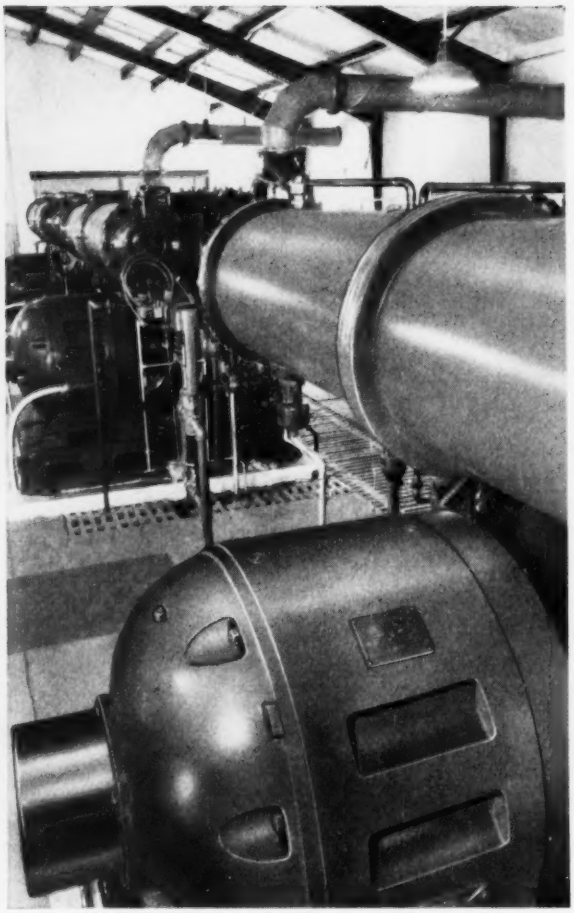
Thanks to the carefully planned flexibility of this electrical system, the Calera Company met government requests to increase the concentrator's capacity by 40 per cent without serious delay.

GENERAL ELECTRIC

TURN PAGE FOR PHOTO REPORT

1. ORE TRANSFERRED ON MINE LEVEL is handled by this 4-ton General Electric battery trammer.

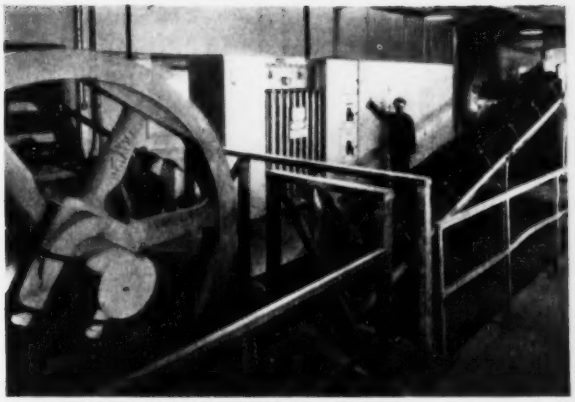
2. DEPENDABLE VENTILATION—to clear the air after blasting in the mine—is provided by this 30-hp totally-enclosed G-E motor. It runs continuously when the mine is worked.



3. AIR COMPRESSORS are driven by 300-hp G-E motors. Compressor building also houses a standby diesel generator which supplies emergency power for surface plant facilities.

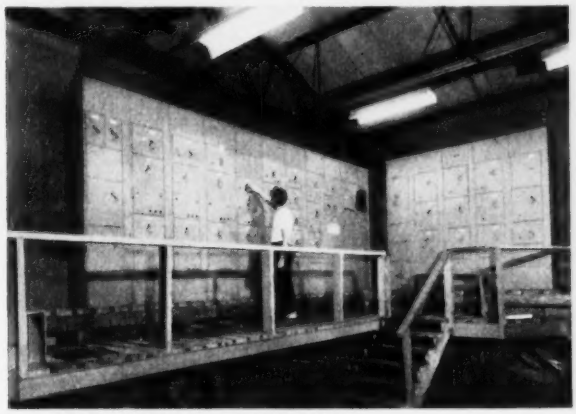
Major cobalt mine in U.S. relies

THIS 1000-TON CONCENTRATOR at Cobalt, Idaho, separates a copper, a cobalt, and an iron product. Crushing plant and concentrator are located close to mine portal. Treatment involves long conditioning of the pulp with lime at 80 to 90 degrees Fahrenheit.

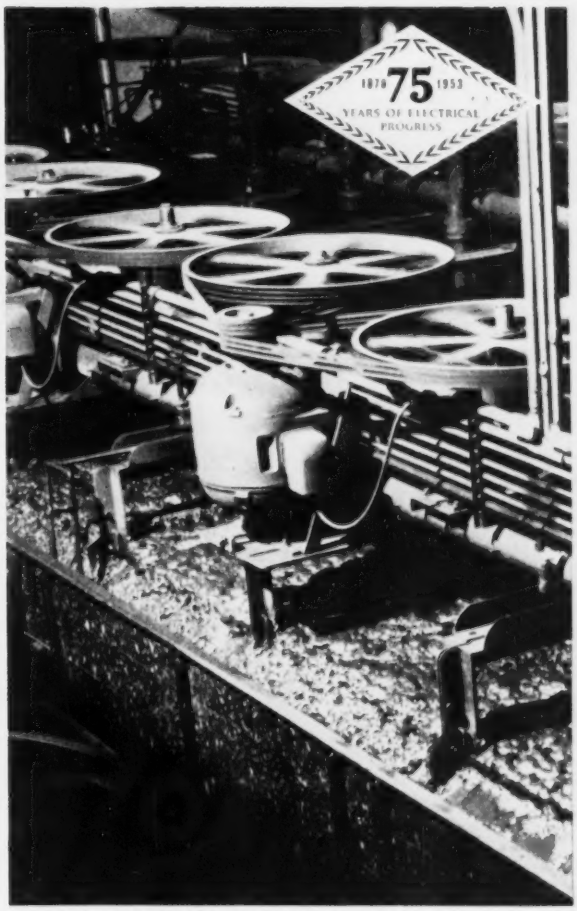


4. PRIMARY AND SECONDARY CRUSHERS—driven by G-E Tri-Clad* motors—are supplied from a 480-volt wye-connected, solidly grounded G-E load-center unit substation.

*Registered trade-mark of General Electric Co.



5. CONTINUITY OF PRODUCTION is better assured by this General Electric motor control center. It contains small motor starters, feeders for crane, lighting and power circuits.



6. ORE IS PROCESSED in flotation cells, driven by G-E motors, then concentrates are shipped to the Howe Sound Company's new $2,500,000 cobalt refinery at Garfield, Utah.

on co-ordinated electrical system

More than two years of pilot-plant testing—and the development of a novel technique of selective cobalt flotation—was needed before the new Calera mill started operating as the first major source of domestic cobalt.

To assure reliable power distribution and motor operation for the new installation, Howe Sound specified G-E equipment throughout. G-E application engineers, working closely with Howe Sound's engineers, designed a completely co-ordinated electrical system. Further, G-E service engineers were on hand for equipment start-up and during the "breaking-in" period. As an indication of their satisfaction with the electrical system, Howe Sound specified G-E equipment for their new $2,500,000 cobalt refinery at Garfield, Utah, just now going into operation.

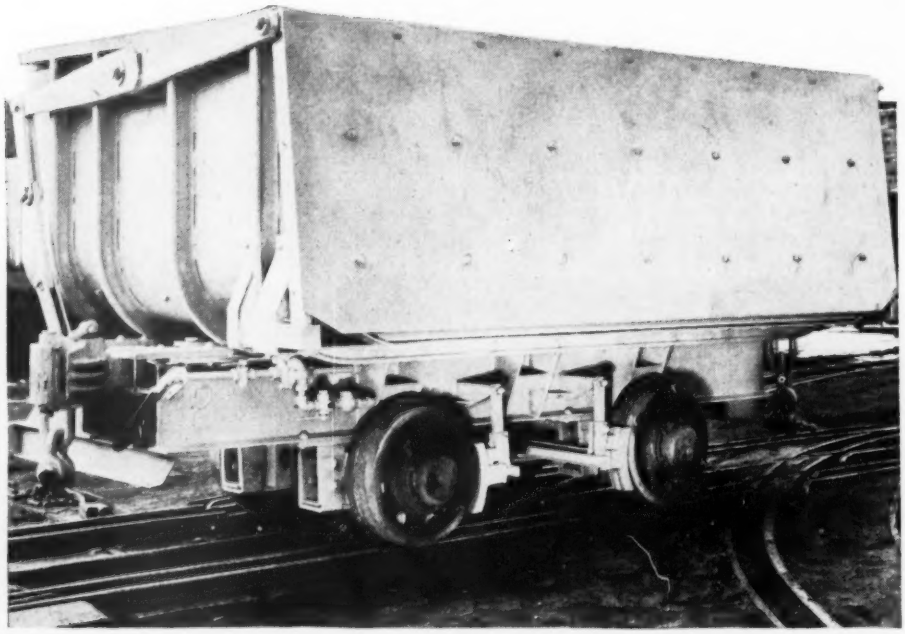
Whatever your electrical needs—large or small, modernization or expansion—G-E application engineers can help you and your consultants. Contact your local G-E Apparatus Sales Office. General Electric Co., Schenectady 5, N. Y.

660-28

Engineered Electrical Systems for the Mining Industry

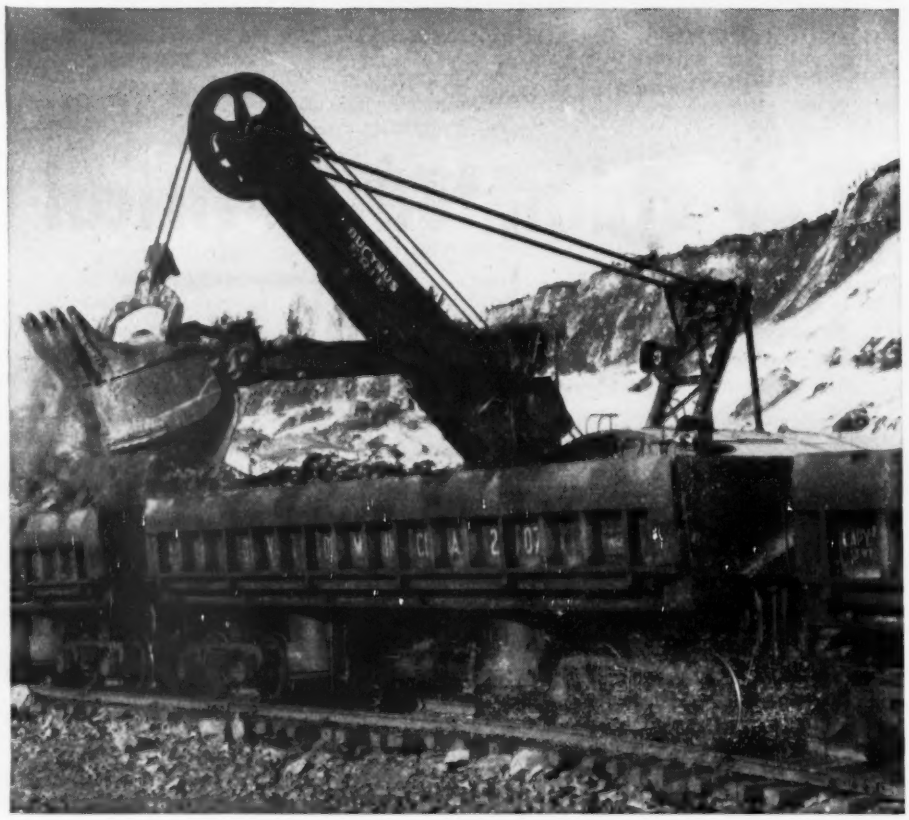
GENERAL ELECTRIC

This mine equipment does more



Still in good condition after handling 112,000 tons of abrasive ore.

30 mine cars like this were built by the C. S. Card Iron Works for the Cananea Consolidated Copper Company in 1948. U·S·S COR-TEN High Strength steel was used to make all body and liner plates. To date, each of these cars has handled 112,000 tons of ore, and every one of them is still on the job—still in good condition. These COR-TEN-built cars proved to be so durable that the Cananea Consolidated Copper Company has purchased 30 more.



Stronger, more durable. Yet, the weight of these cars was cut by 25,000 pounds.

In this application, U·S·S TRI-TEN steel was used to reduce weight without reducing strength. These 100-ton Western cars, each of which is capable of carrying 40 cubic yards of ore level-full, were built by Baldwin-Lima-Hamilton Corporation, Eddystone Division for use in a Mesabi open pit mine by the Oliver Iron Mining Division. By taking advantage of the higher strength and greater toughness of TRI-TEN steel these cars were built 25,000 pounds lighter than if plain steel had been used. Yet, the cars are stronger, more durable and better able to withstand cold weather operations. Because of reduced deadweight, each car can haul 25,000 pounds more ore than a similar carbon steel car.

and lasts longer because

U·S·S High Strength Steels

give it the stamina to stay on the job.

With higher-than-ever operating costs threatening every penny of profit, the full value of your investment in mine equipment must be realized. Every piece of equipment you use must produce to its full capacity. To do that, it must be able to take the day-in day-out punishment of today's high speed operations.

Equipment built with U·S·S HIGH STRENGTH STEELS can take that kind of punishment. And this shows up in your books. You spend less money for replacements and repairs. You get more output because there's less down-time.

U·S·S HIGH STRENGTH STEELS are used to give each part the particular qualities it needs to do its job best. U·S·S Cor-Ten steel, for example, provides four to six times the resistance to atmospheric corrosion of ordinary structural steel. U·S·S A-R (Abrasion-Resisting) steel offers maximum resistance to wear and abrasion. And U·S·S Tri-Ten steel gives equipment greater ability to withstand shock at sub-zero temperatures. It is also possible to increase the strength of a part without increasing its weight by replacing ordinary steel with either U·S·S Cor-Ten, U·S·S Tri-Ten or U·S·S Man-Ten steels. Or, conversely, weight can be reduced without reducing strength. That's because these famous "steels that do more" have a yield point 50% higher than that of ordinary structural steel.

Make sure that U·S·S HIGH STRENGTH STEELS are used in your equipment. They'll help you increase output and save you money at the same time.

For more facts, or specific application data, write to our nearest office.

Resists corrosion, even in the hot, humid atmosphere of a Florida phosphate pit.

The Caterpillar Diesel Tractor and Caterpillar Scraper shown here offer further evidence of the durability of U·S·S High Strength Steels under severe conditions. In the warm, humid atmosphere of a Florida phosphate pit, corrosion is a constant menace to equipment. U·S·S Tri-Ten steel offers good resistance to atmospheric corrosion—three times that of structural carbon steel. What's more, it offers greater resistance to shock, abrasion and impact. And its fatigue strength is 50% greater than plain steel. Caterpillar Tractor Co. has long relied on U·S·S Tri-Ten steel to give its equipment the ruggedness and durability for which it is famous.

UNITED STATES STEEL CORPORATION, PITTSBURGH · AMERICAN STEEL & WIRE DIVISION, CLEVELAND · COLUMBIA GENEVA STEEL DIVISION, SAN FRANCISCO
NATIONAL TUBE DIVISION, PITTSBURGH · TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. · UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

U·S·S HIGH STRENGTH STEELS

3-203

UNITED STATES STEEL

WHAT *Life-Line* REALLY DELIVERS IS MORE SERVICE...LESS SERVICING

See how the maintenance has been engineered out with modern *Life-Lines*

Forget your previous ideas of motor and control maintenance. The advanced design of Life-Line motors and Life-Linestarters sets new lows in maintenance. Excessive maintenance has been engineered out—in advance.

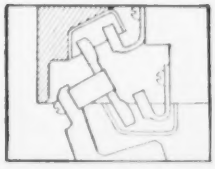
Take the Life-Linestarter for example: There are fewer moving parts. Operation is simple. No complex linkage in contact closing arrangement. No sliding surfaces. No hinge pins. Contacts, too, are protected by the exclusive deionizing principle of arc extinction—the most efficient method devised. Contact burning is minimized—contact maintenance engineered out!

And the Life-Line motor has set new standards for motor manufacturers. Pre-lubricated bearings do away with lubrication maintenance. Heavy structural steel gives new strength . . . provides more torque per pound. New stator slots and insulating material add years of maintenance-free service.

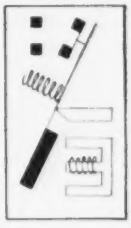
Summed up—what is really engineered and built into Life-Lines is simply—more service on the job—less servicing, and down time. Ask your Westinghouse representative to show you proof that Life-Line motors and Life-Linestarters are the equipment built to match the high productivity requirements of today's industry. A call to your local office will bring you fast service, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21696-A

YOU CAN BE SURE... IF IT'S

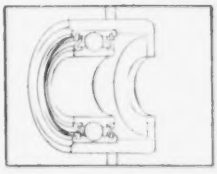
Westinghouse



STARTER *Exclusive "De-ion®" Arc Quencher* confines, divides, extinguishes hot arcs fast!



Never Jams. No sliding surfaces to wear—no sticking—no jamming—nothing to wear or replace.



MOTOR *Needs No Lubrication.* Prelubricated factory-sealed bearings eliminate troubles due to over or under lubrication, dust and dirt.

Cuts Winding Burnouts. Pear-shaped slot design eliminates pockets. No corner voids remain to collect dirt, moisture.

faster by far...

THAN ANY OTHER DIAMOND DRILL

Powerful, light-weight and easy-to-handle, the CP-55 Diamond Drill is faster than any other diamond drill in its class! With a highly efficient CP Rotary Air Motor, it requires only a minimum amount of air per foot drilled. It's a real time saver, too! Can be used for blast hole and exploratory drilling with equal efficiency.

This rugged, Chicago Pneumatic Diamond Drill has delicate bit control which keeps bit costs down and affords high core recovery. Has self-aligning rod puller for holes deeper than 100 feet. Conservatively rated at 500 feet with E Rods and EX Fittings. For more details, write for Bulletin 318. *Chicago Pneumatic Tool Company, 8 East 44th St., New York 17, N. Y.*

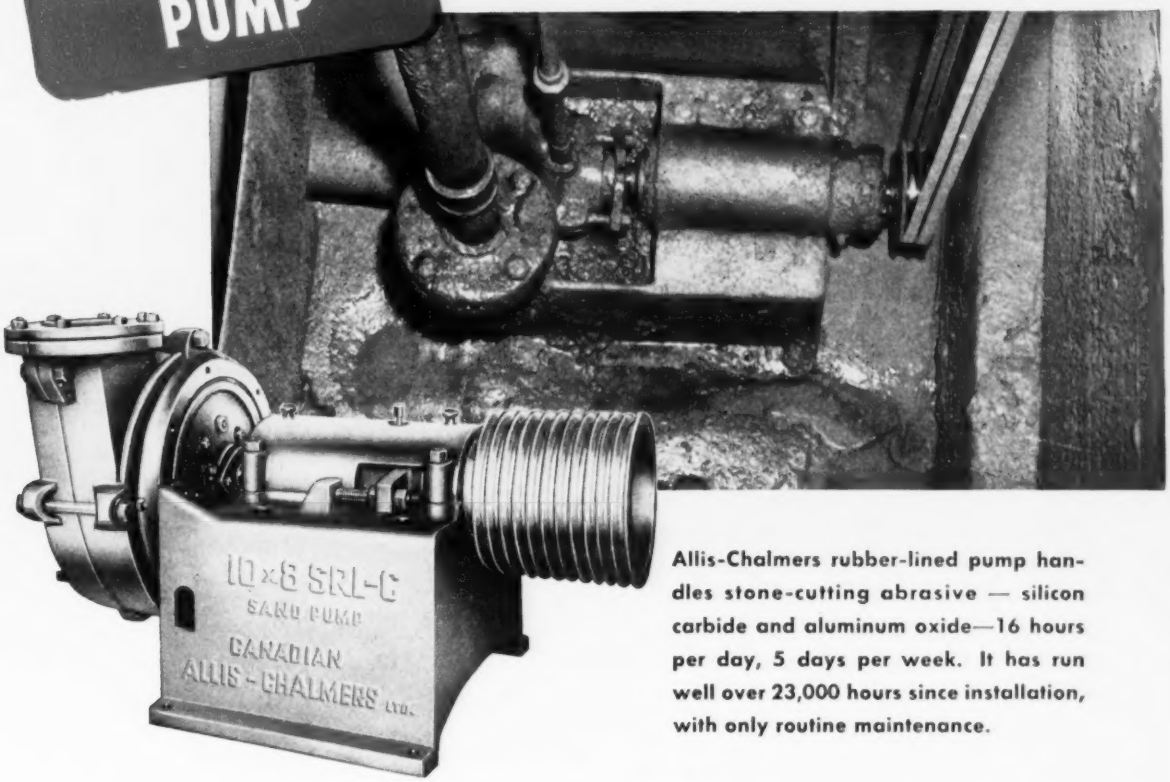
Chicago Pneumatic

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

. . . OVER 23,000 HOURS and still running!

(Best Previous Pump — 1040 Hours)

ALLIS-CHALMERS RUBBER-LINED PUMP



Allis-Chalmers rubber-lined pump handles stone-cutting abrasive — silicon carbide and aluminum oxide—16 hours per day, 5 days per week. It has run well over 23,000 hours since installation, with only routine maintenance.

PUMPING RECORDS like this are not unusual with the Allis-Chalmers rubber-lined pump. Service life up to 50 times that of the best alloy pumps is common. Pumping costs are greatly reduced because of reduced maintenance and repair costs and also because of fewer production interruptions and less lost production time.

Unique Lining Method

The rubber lining of the Allis-Chalmers SRL rubber-lined pump is bonded to a heavy steel skeleton which is bolted into the casing. This arrangement provides maximum support for the liners but makes them easy to remove when it is found necessary.

Each Installation Specially Engineered

Every pump is individually engineered to provide the best possible performance for the application involved. Special rubber linings of various compounds handle a wide variety of slurries at low cost per gallon pumped.

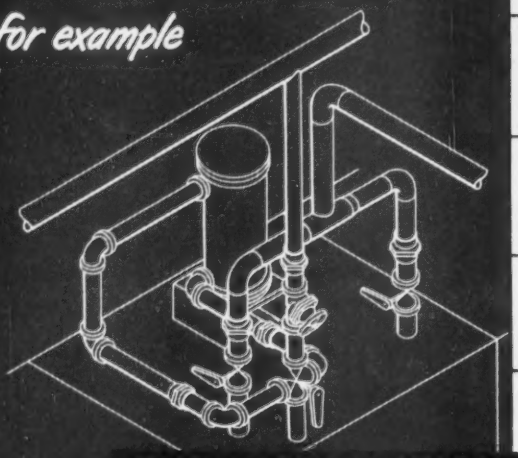
If you are handling sand, taconite, grinding mill discharge, tailings or any other abrasive slime or slurry and want longer pump life, see your Allis-Chalmers representative. Or write Allis-Chalmers, Milwaukee 1, Wis., and ask for Bulletin 08B7311.

A-3953

ALLIS-CHALMERS

Are Your Valves Behaving This Well?

...on River Water, for example



THE INSTALLATION

Crane Iron Body Diaphragm Valves on hydraulic lines to cylinder operators on ash pit gates; Southwark Station; Philadelphia Electric Company.

VALVE SERVICE RATINGS

SUITABILITY:	Good design for gritty fluid
FEATURES:	Neoprene disc insert resists cutting
MAINTENANCE COST:	Making big savings here
SERVICE LIFE:	Already 6 to 9 times longer than other valves
CORROSION-RESISTANCE:	O.K. no sign of corrosion
PRICE:	Better than many ordinary valves
AVAILABILITY:	Regular number in Crane line

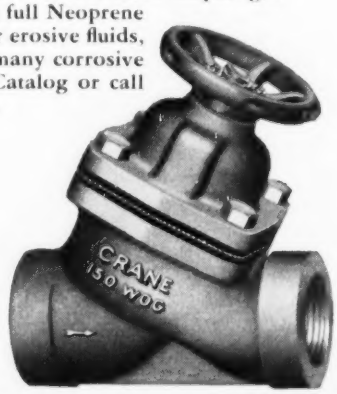
THE HISTORY

Valves were installed in the hydraulic system when the control cocks failed to shut off tight. But like the cocks, conventional valves put in this service didn't stand up. They couldn't handle the abrasive, sandy river water used for hydraulic operators as well as for ash pit sluicing. They leaked badly in 3 to 5 weeks; had to be replaced.

The problem was solved with Crane Iron Body Diaphragm Valves. Installed more than 7 months, there's been no leakage since; no valve trouble of any kind. The Neoprene disc insert and wide, flat seating surfaces in Crane Valves show no effect of abrasion. Their completely sealed bonnet keeps working parts free of grit.

THE VALVE

In Crane Packless Iron Body Diaphragm Valves, the Neoprene diaphragm acts as bonnet seal only; is not subject to crushing and rapid wear. Separate disc with Neoprene insert shuts off flow even should diaphragm fail. Made unlined or with full Neoprene body lining. Well suited for erosive fluids, sludges, slurries; also for many corrosive services. See your Crane Catalog or call your Crane Representative.



The Complete Crane Line Meets All Valve Needs. That's Why

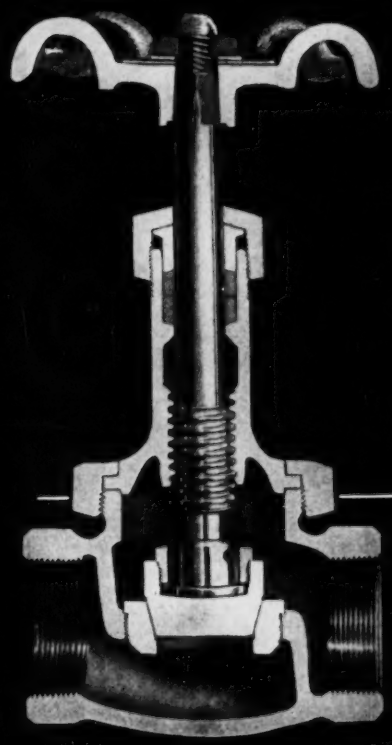
More Crane Valves Are Used Than Any Other Make!

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois

Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING



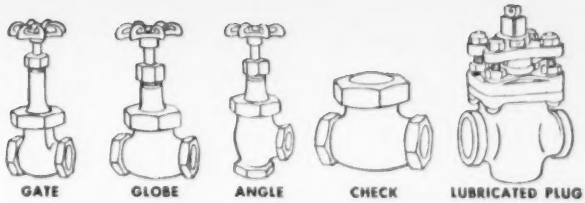
BRONZE

COMPLETE LINES OF BRONZE VALVES AND PIPE FITTINGS are manufactured by Walworth in a variety of types, pressure ratings, sizes, and patterns, including Walseal® Bronze Valves and Fittings for making Silbraz® joints.

Walworth also manufactures complete lines of valves and fittings – including Lubricated Plug Valves – made of steel, iron, and special alloys as well as bronze.

Walworth-made valves, pipe fittings, and pipe wrenches, total approximately 50,000 items–all sold through distributors in principal centers throughout the world.

Walworth engineers will be glad to help you with your problems. For full information call your local Walworth distributor, nearest Walworth sales office, or write to Walworth Company, General Offices, 60 East 42nd Street, New York 17, N. Y.



Bronze valves in gate, globe, angle, check, and lubricated plug types are manufactured by Walworth. Illustrated is a sectional view of a Walworth No. 225P Bronze Globe Valve. This valve has a working steam pressure rating of 350 psi at 550F (1,000 psi non-shock cold water, oil, and gas pressure). It features a renewable, plug type, stainless steel seat and disc, heat treated to 500 Brinell hardness.

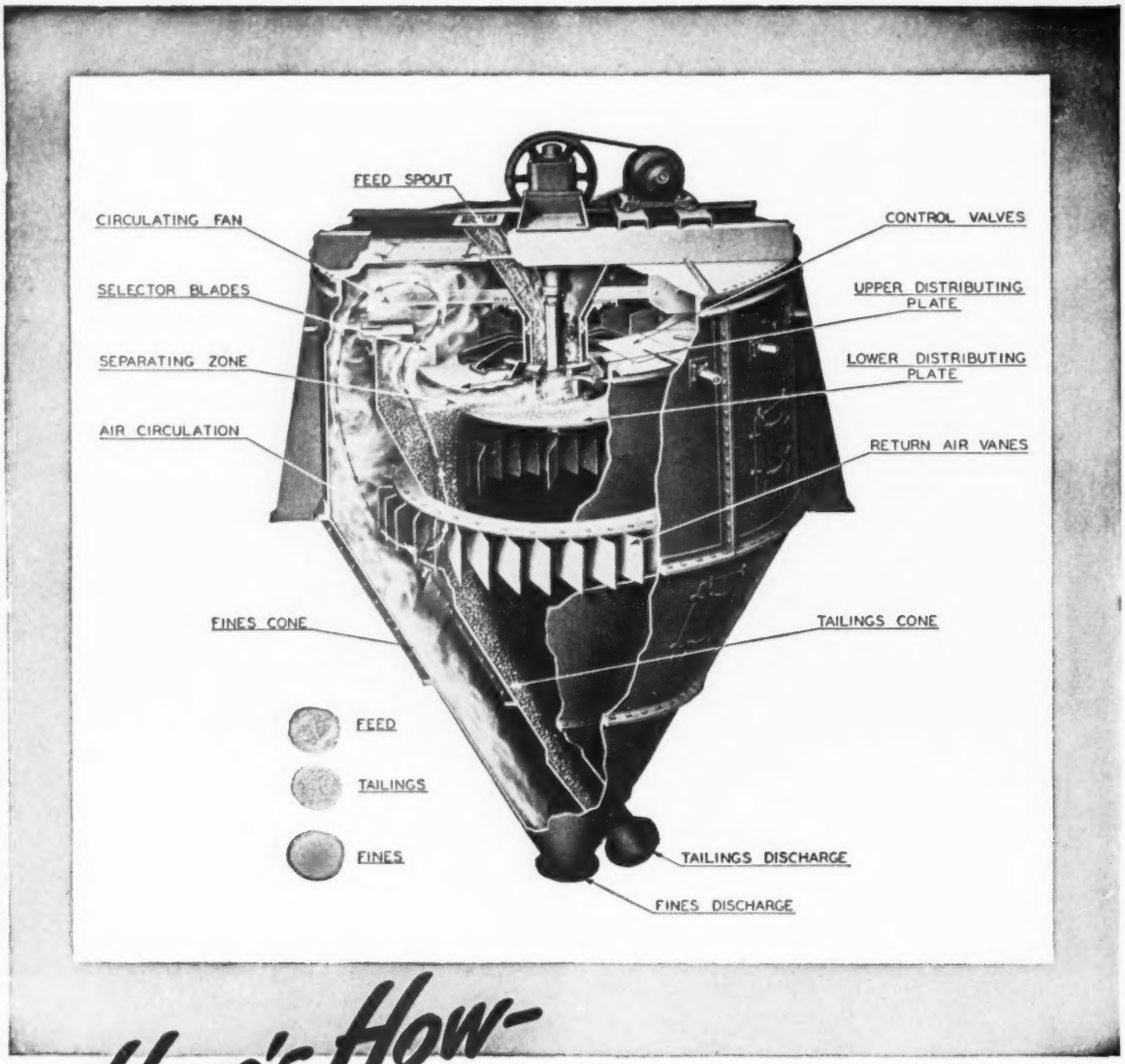
WALWORTH

Manufacturers since 1842

valves . . . pipe fittings . . . pipe wrenches

60 East 42nd Street, New York 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD



Here's How—

STURTEVANT AIR SEPARATORS

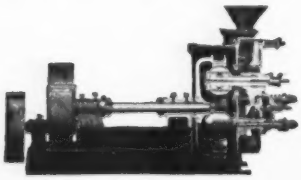
Produce accurate fines with increased output up to 300%

Exact regulation and control of centrifugal forces and air currents, one counteracting and overbalancing the other so precisely that by simple adjustments a product of almost any desired fineness is selected and collected, while coarser sizes are rejected . . . that's the principle of operation of Sturtevant Air Separators.

The benefits you derive from this separator are—increased output by as much as 25% to 300% . . . lower power costs by 10% to 50% . . . reduced maintenance.

A typical on-the-job example is as follows—a 16 ft. separator takes a feed of 750 tons per hour containing only a small percentage of the desired product and delivers 30 tons of material 90%, minus 200 mesh.

Investigate Sturtevant Air Separators today. Write for information and bulletin.



RING ROLL MILL

Capacities from 12 to 18 tons per hour. Range 10 to 200 mesh. Use this mill in closed circuit with Sturtevant Air Separators.

STURTEVANT
MILL COMPANY
101-A Clayton Street, Boston 22, Massachusetts
Designers and Manufacturers of
CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS
MECHANICAL DENS and EXCAVATORS • ELEVATORS • MIXERS

Up steep hills—on loose gravel and sand piles over sharp rocks—slush, mud, gravel—out and over the highway **GENERALS** deliver more loads

Faster! Easier! At Lower Cost!

THE GENERAL L.C.M.

THE GENERAL H.C.T.

GENERAL L. C. M.—for most work off-the-road. Massive tread and thick, tough shoulders develop extra traction. Extra wear on tough, jagged surfaces. Stronger rayon cord body with more natural rubber built into its shock-absorber design.

GENERAL H. C. T.—for more work on-the-road. Thick, saw-tooth tread supported by broad, angled shoulder cleats develop extra traction. Smoother rolling, quicker stopping. More original and more recap miles.

Make Every Worn Tire Work Longer for More Profit!

Your GENERAL TIRE DEALER will KRAFT SYSTEM RECAP Worn Tires with the New GENERAL Truck Tire Tread of Your Choice

You're throwing away money when you throw away worn tires or accept an ordinary "adjustment" for them. Let your General Tire Dealer—a tire expert—restore worn tires with famous factory controlled Kraft System Recapping. You choose from the complete line of on and off-the-road new General Tire treads and he'll put that tread on your worn tire. He can do sectional repairs too. Get Kraft System Recapping—get more profit from every tire.

KRAFT SYSTEM RECAPPING
A GENERAL TIRE SERVICE

SPECIFY GENERAL TIRES ON YOUR NEW EQUIPMENT

"There's only ONE reason!"

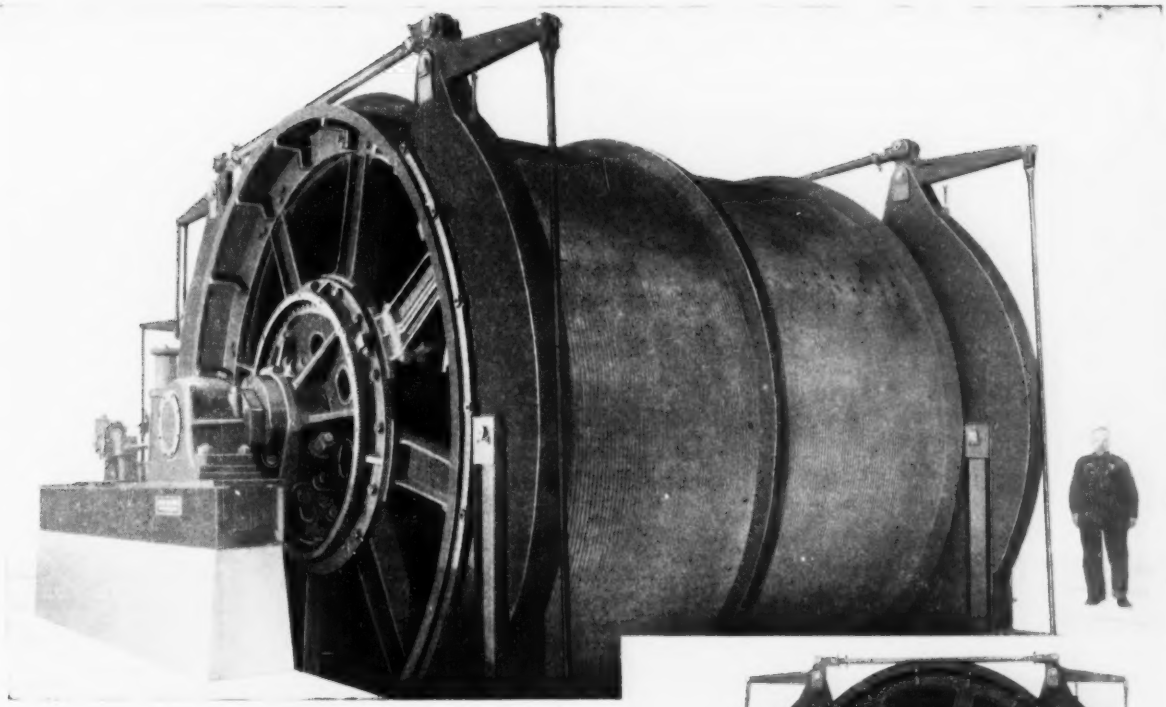
IT'S JUST THAT SIMPLE. There's only one reason in the world why 2 out of 3 wire rope users in the mining field prefer Roebling wire rope . . . *it costs a lot less on the job than any other.*

For maximum wire rope efficiency and economy, call your nearest Roebling office for a Field Man. He'll recommend the best ropes for your requirements.

JR ROEBLING **ROEBLING** CF&I

A subsidiary of The Colorado Fuel and Iron Corporation

JOHN A. ROEBLING'S SONS CORPORATION, TRENTON 2, N. J. BRANCHES: ATLANTA, 934 AVON AVE. • BOSTON, 51 SLEEPER ST. • CHICAGO, 5525 W. ROOSEVELT RD. • CINCINNATI, 3253 FREDONIA AVE. • CLEVELAND, 13225 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST. • DETROIT, 915 FISHER BLDG. • HOUSTON, 6216 NAVIGATION BLVD. • LOS ANGELES, 5340 E. HARBOR ST. • NEW YORK, 19 RECTOR ST. • ODESSA, TEXAS, 1930 E. 2ND ST. • PHILADELPHIA, 230 VINE ST. • SAN FRANCISCO, 1740 17TH ST. • SEATTLE, 900 1ST AVE. S. • TULSA, 321 N. CHEYENNE ST. • EXPORT SALES OFFICE, TRENTON 2, N. J.



Another Giant Hoist

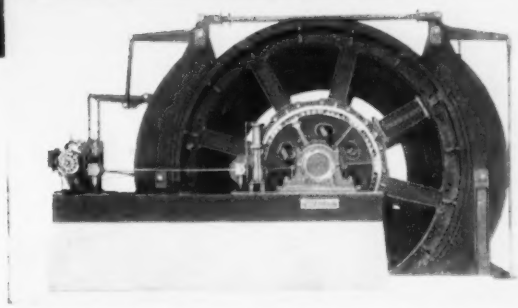
for Service Overseas

This huge electric mine hoist embodies every approved advantage for fast, safe, hoisting in a shaft 800 meters deep. Designed primarily for balanced hoisting of men and materials from several different levels, it will be used also, at times, for hoisting ore. Vulcan double-deck cages and "Allcasteel" sheaves were furnished for the same installation.

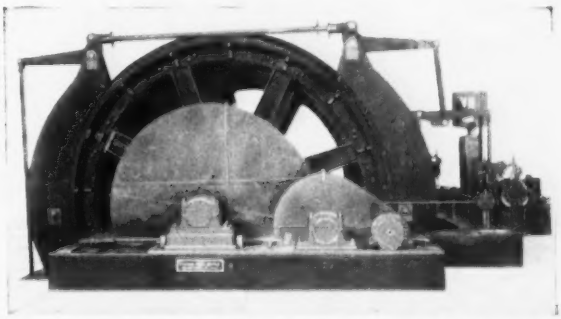
Each of the two all-steel built-up cylindrical drums is 18′-0″ in diam. by 8′-1″ in width with accurately-machined helical grooves for stowing approximately 2800 feet of 1½″ rope in one layer. The "loose" drum is equipped with a positive toothed-type clutch. Parallel-motion post-type brakes on each drum are equipped with pressure-graduating rigs and controlled by dependable safety devices which apply the brakes automatically in event of power-failure, overspeed or overtravel. Brakes and clutch are both operated by oil-hydraulic engines and, on the loose drum, are mechanically and electrically interlocked.

Other superior features, here illustrated and described, combine to assure the dependable trouble-free service that has made Vulcan hoists the standard of the mining world for more than a hundred years.

Correspondence is invited regarding any requirement for heavy-duty hoists, sheaves, cages, skips, etc. Illustrated bulletins mailed promptly on request.



Shop assembly, showing positive toothed-type clutch, oil-hydraulic clutch engine and, at extreme left, oil-hydraulic brake engine controlled by Lilly safety device. Heavy weights for applying the brakes will be located in pits below the floor level.



Shop assembly, showing oil-tight welded-steel casings for double-reduction herringbone gears, through which the hoist will be driven by a 500 hp. wound-rotor induction motor. Main shaft and both pinion shafts are mounted on self-aligning spherical roller bearings. Other modern features include a Trip Recorder, a Recording Tachometer and a Centralized-Control Desk on the floor level.

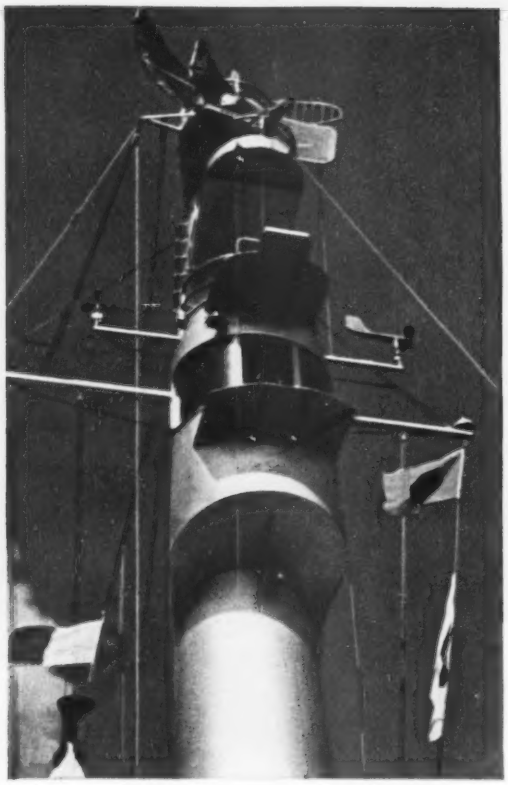
Vulcan Iron Works

Established 1849

WILKES-BARRE, PA., U.S.A.

New York City Office, 50 Church Street

DESIGNERS AND BUILDERS OF ELECTRIC HOISTS, "ALLCASTSTEEL" SHEAVES, CAGES, SKIPS, GUNBOATS, ETC., UNDERGROUND CONVEYORS AND ALL TYPES OF LOCOMOTIVES FOR BOTH UNDERGROUND AND SURFACE HAULAGE



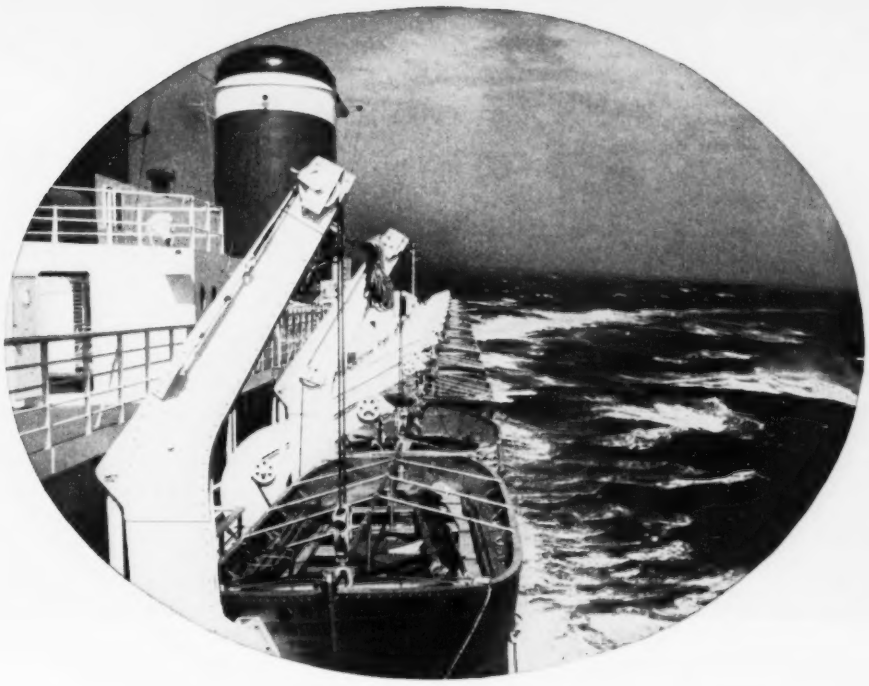
Dramatic radar tower of the S. S. United States. The ship was designed by Gibbs & Cox, Inc., built by Newport News Shipbuilding and Drydock Co., and is operated by U. S. Lines, Inc.

S. S. UNITED STATES MADE WITH BRICK!

The majesty of her revolutionary radar tower, and the sweeping lines of her boat deck, are creations of aluminum. More aluminum has been used in this flagship of America's merchant marine fleet than in any other single structure on land or sea. And virtually all of this great ship owes its existence to brick.

Refractory brick, lining the furnaces and smelters of the aluminum industry, which has grown to gigantic proportions in recent years. In the furnaces used in the production of this strong, light, long-lasting metal, many a GREFCO refractory is giving superior service.

GREFCO products also help produce every other non-ferrous metal—copper, gold, platinum, bronze, brass, lead, nickel, zinc, tin, silver and magnesium—all of which are integral to the great vessel. These non-ferrous metals demand such a wide variety of refractories that only GREFCO can supply completely in quantity and quality.



In the huge, modern reverberatory type copper smelting furnaces, GREFCO's RITEX basic brick are a favorite in the side walls where slag conditions are acute. In the arch or roof, where severe service conditions are encountered, experts have found that a basic arch of RITEX and STEELKLAD means fewer replacements or less maintenance.

GREFCO high duty or super duty fireclay brick are available for flue construction. In some front walls, SEMALU (50% alumina) or ARCO (60% alumina) are used. GREFCO burned magnesite or RITEX have become leaders in the industry for lining converters, and RITEX, STEELKLAD, high alumina brick and GREFCO mortars and specialties find their way into many another furnace used in the production of non-ferrous metals.

In *your* furnace . . . all along the production line . . . there's a GREFCO product to meet your needs. From 66 mines and manufacturing plants, these refractories flow to industry in quantity and quality. And GREFCO's staff of service research engineers is at your command to determine the proper application. Truly, you can depend on GREFCO for a *complete refractories service!*

GENERAL REFRACTORIES COMPANY
PHILADELPHIA

GENERAL REFRACTORIES

Disposal of 1140 long tons per hour of overburden and lean ore is easily accomplished by this Link-Belt 36-in. wide belt conveyor system.

TOTAL ENGINEERING

It's LINK-BELT's answer for improved belt conveyor performance

BELT conveyor efficiency begins with correct analysis of overall system requirements. And right from the start Link-Belt offers you unique advantages. Our engineers can apply broad experience to your bulk handling problems.

Working with a complete line of quality components, they can select the belt conveyor equipment best suited to your exact needs. What's more, Link-Belt has a nation-wide engineering organization that will follow through on every detail. This includes supplying all related equipment . . . building supporting structures and enclosures . . . erecting the complete job, if desired.

It's easy to see why "total engineering" results in top belt conveyor performance. For complete information, call the Link-Belt office near you today.

13.139-O

LINK-BELT

BELT CONVEYOR EQUIPMENT

LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices in Principal Cities.

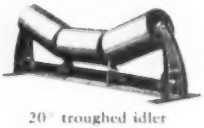
LINK-BELT builds a complete line of belt conveyor components

ALL TYPES OF ROLLER BEARING IDLERS

Impact-cushioning idler

45° troughed idler

Belt-training idler

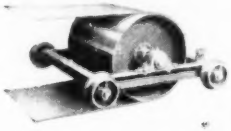


20° troughed idler

Return idler

BELT AND MOTOR PROPELLED TRIPPERS

COMPLETE TERMINAL MACHINERY



"Plain Primacord will hug the Plastic in a tight double hitch...

"I use Plastic Reinforced Primacord for unusual wet conditions, and in deep holes, or wherever field shots must stand a long time before blasting. It has a tough, plastic cover and will take a lot of punishment. It is not affected by high summer heat or winter cold.

"I use a trunk line of flexible Plain Primacord and make a double half hitch around the Plastic Reinforced branch line at a right angle, like this. The textile covered Plain Primacord grips securely in a tight double loop around the plastic cover without slipping.

"Tight right-angle Primacord connections all along the line go a long way toward giving you a good shot every time."

Ask your explosives supplier or write for further facts to

THE ENSIGN-BICKFORD COMPANY
Simsbury, Connecticut
Also Safety Fuse Since 1836

Here **Plastic Reinforced Primacord** is used for the branch line, and **Plain Primacord** for the trunk line. Note the double half hitch around the plastic cover. It pulls up tight and stays that way.

Other brands to serve your needs are: **Reinforced Primacord,** for deep holes and resistance to abrasion; and **Wire Countered Primacord,** for deep, ragged holes.

P-3

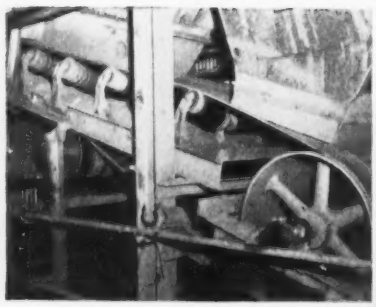
Use The PROVED and APPROVED DETONATING FUSE

S-A CONVEYING Systems set

NEW TONNAGE RECORDS HERE!

An S-A 1200-foot Belt Conveyor and its associated equipment, has increased the loading capacity of this ore dock by as much as 50%. Another case history of S-A Conveying Systems in action.

When an S-A engineer digs into any bulk handling problem, he brings to it a wealth of experience. It has been gained through thousands of S-A Systems engineered to meet just about every kind of bulk handling need. He works with a *complete* line that includes every type of bulk handling equipment. With this "know-how," plus the equipment to back it up, he can *always* recommend the combination that's best for *you*, to do *your* job at lowest cost per ton. A letter will make his services available to you.



S-A Simplex Carriers are used throughout, with pneumatic shock-type carriers at loading and transfer points.

Ore from the stock-pile is picked up by the bridge and dumped into a 60-ton hopper. It is transferred by an S-A Amsco Feeder from the hopper to the 42", 1200-foot conveyor belt. At the far end, an inclined belt discharges into a 100-ton surge bin. Another Amsco Feeder delivers the ore to a weigh hopper, from which it is chuted into rail cars.

Belt Conveyors
Belt, Pan and Plate Feeders
Ship Loading Boom Conveyors
Stacking Conveyors
Storage and Reclaiming Systems
"Natural Frequency" Vibrating Conveyors
REDLER Conveyor-Elevators
ZIPPER Conveyor-Elevators
Conveyor Belt Cleaners
Headshaft Holdbacks
Grizzlies and Screens
Centrifugal Pilers
Bin Gates and Tunnel Gates
Car Pullers and Spotters
Bucket Elevators
Skip Hoists
SEALMASTER Ball Bearing Units

• Write for a bulletin on any of the above.

STEPHEN S-A DAMSON MFG. CO.

4 Ridgeway Avenue, Aurora, Illinois — Los Angeles, Calif., Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

ROCK RATED

to bring your digging up to date

MODEL 1055 — 3½ yards
MODEL 955A — 2½ yards

You have the jump on costs when your new P&H takes over the tough digging jobs. Why? Because there's no other machine to match its performance. You have the speed — a 15% to 25% faster digging cycle — for bigger production. You have the all-welded strength to take shock loads that would K.O. less rugged machines. You have the stability to exert more power at the tooth point. That gives you added capacity.

If you're ready to cut your costs, these P&H's are ready to help you.

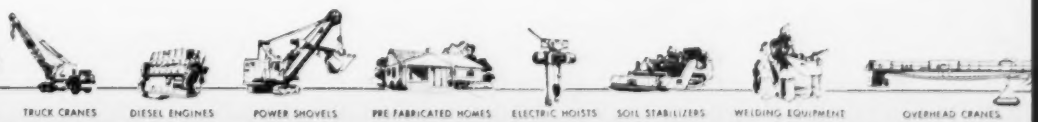
P&H MAGNETORQUE*
ELECTRIC SWING

the greatest shovel improvement in 20 years. It's smoother, faster, more dependable. It eliminates the old swing frictions with their constant headaches and replacement costs. Magnetorque lasts the life of your machine. You should know the facts about it!

**T.M. of Harnischfeger Corporation for electro-magnetic type coupling.*

P&H LARGE EXCAVATOR DIVISION
HARNISCHFEGER CORPORATION
MILWAUKEE 46, WISCONSIN

the P&H *Line*



What Does it Cost to Move a Yard of Earth?

Three MARION 191-M shovels are handling the excavation work for two giant dams on the Missouri River. Their records in soil, clay, shale and rock are making excavating history that will be significant in heavy construction and mining.

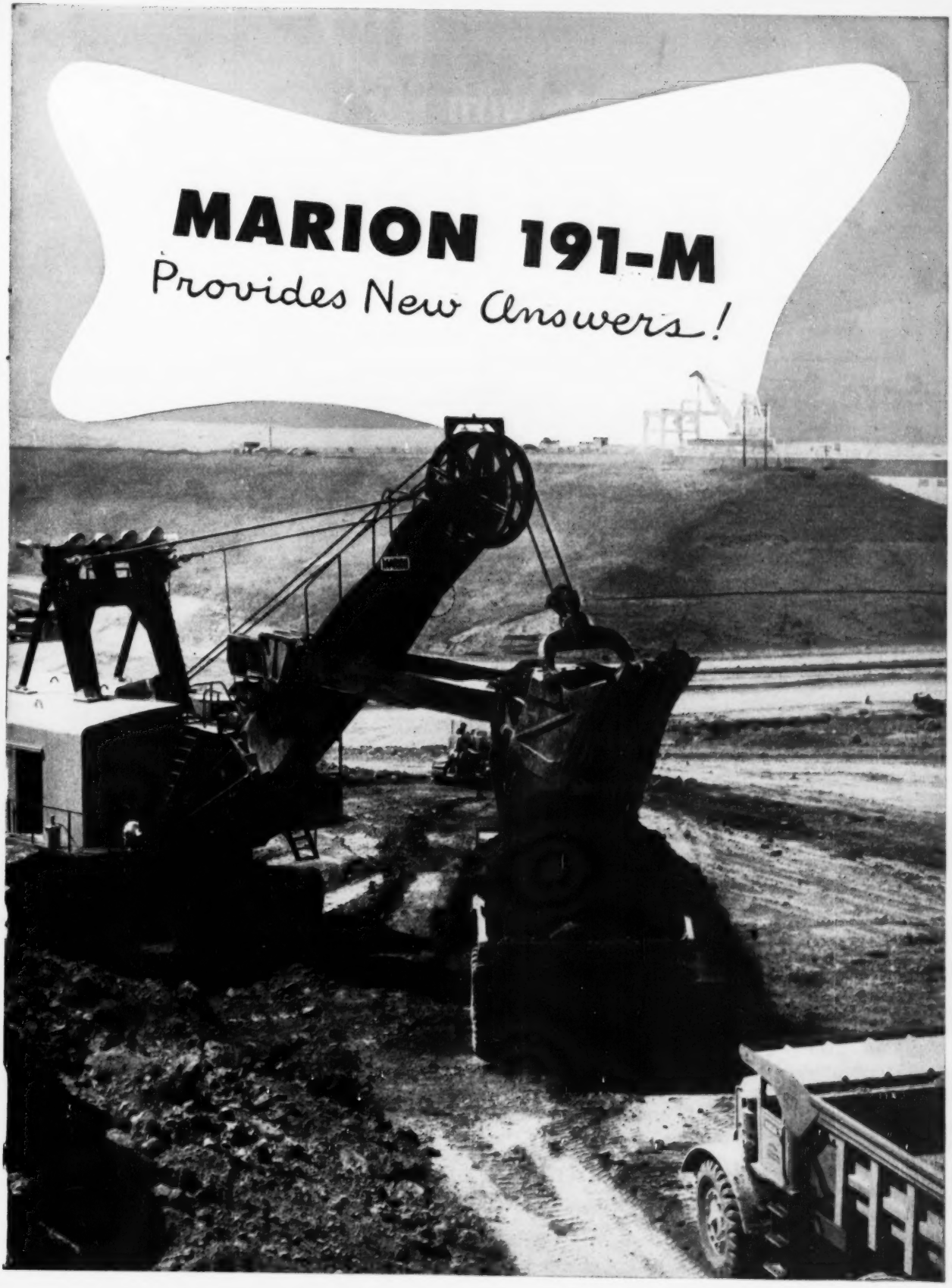
Big dipper capacity, tremendous power and real speed (18-second cycle time—as fast as your smallest machine) make the MARION 191-M an outstanding performer where big yardages are needed. What is the cost of moving a yard of dirt, rock or ore? The 191-M provides new and interesting answers. Write for the details.

MARION POWER SHOVEL COMPANY

Marion, Ohio, U. S. A. • from 3/4 cu. yd. to 45 cu. yds.

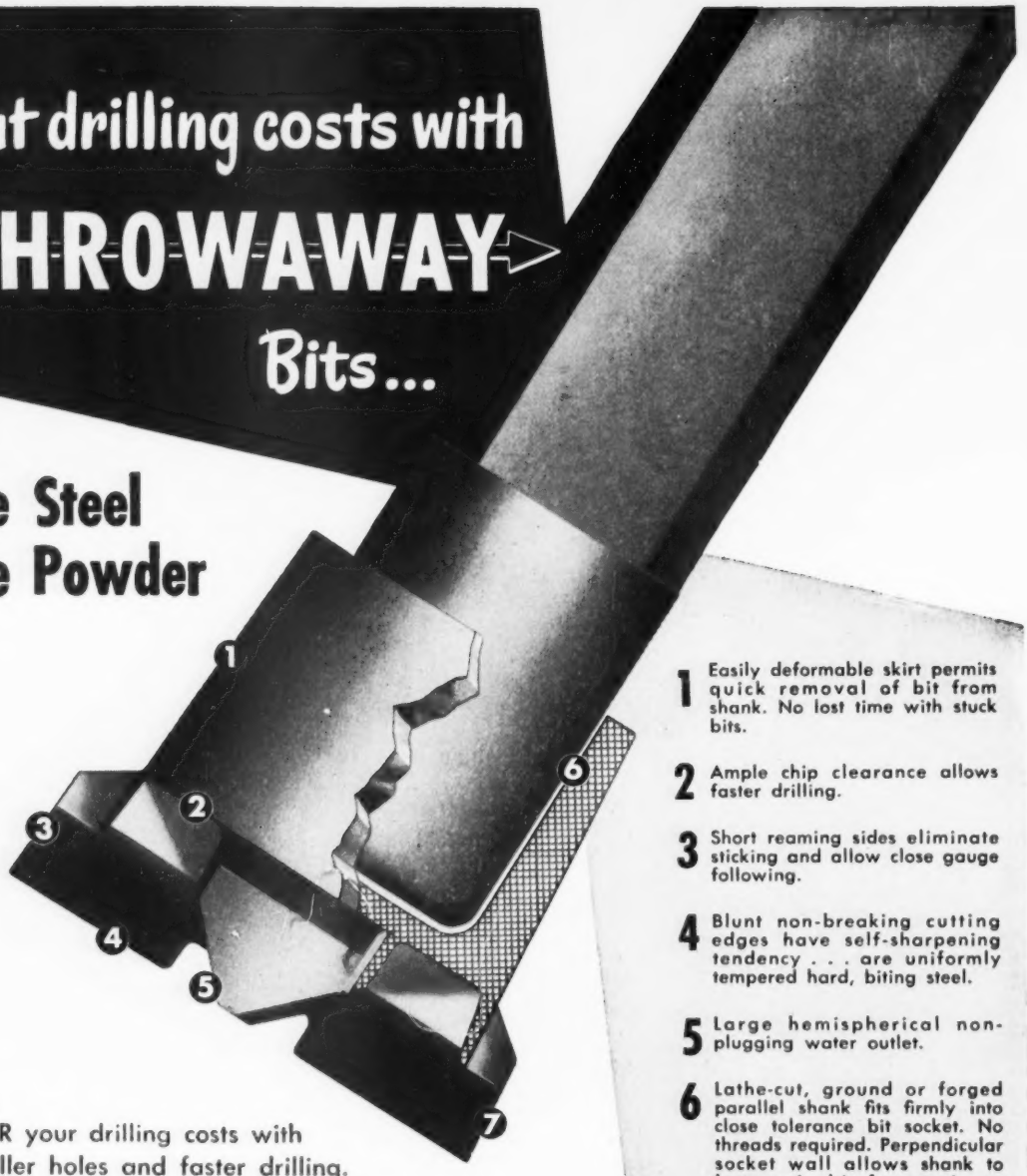
Offices in Principal Cities Throughout the World

MARION 191-M, the world's largest loading shovel, at Ft. Randall Dam.


MARION 191-M
Provides New Answers!

Cut drilling costs with THROWAWAY Bits...

Save Steel
Save Powder



1 Easily deformable skirt permits quick removal of bit from shank. No lost time with stuck bits.

2 Ample chip clearance allows faster drilling.

3 Short reaming sides eliminate sticking and allow close gauge following.

4 Blunt non-breaking cutting edges have self-sharpening tendency . . . are uniformly tempered hard, biting steel.

5 Large hemispherical non-plugging water outlet.

6 Lathe-cut, ground or forged parallel shank fits firmly into close tolerance bit socket. No threads required. Perpendicular socket wall allows shank to bottom in bit for maximum performance.

7 Perfect uniformly treated bit teeth assure best possible cutting power and smooth operation.

LOWER your drilling costs with smaller holes and faster drilling. Bottom with 1¼ inch holes and save costly steel and powder. Let us prove to you that the man at the drill can do more work for less cost with a Throwaway Bit. Write for new low price list and technical description of Throwaway Bit to: Portland, Oregon home office or distributors listed below. Competent field engineers and dealers are always at your service.

THROWAWAY BIT CORPORATION

4200 N. W. YEON AVENUE., PORTLAND, OREGON

BONNE TERRE FARMING & CATTLE CO
Bonne Terre, Missouri

CREATING ENGINEERING
825 1st National Bank Building
Denver, Colorado

GREENAWALT-WHEELOCK & CO.
415 Mills Building
El Paso, Texas

Will a MANCHA pay in your mine?

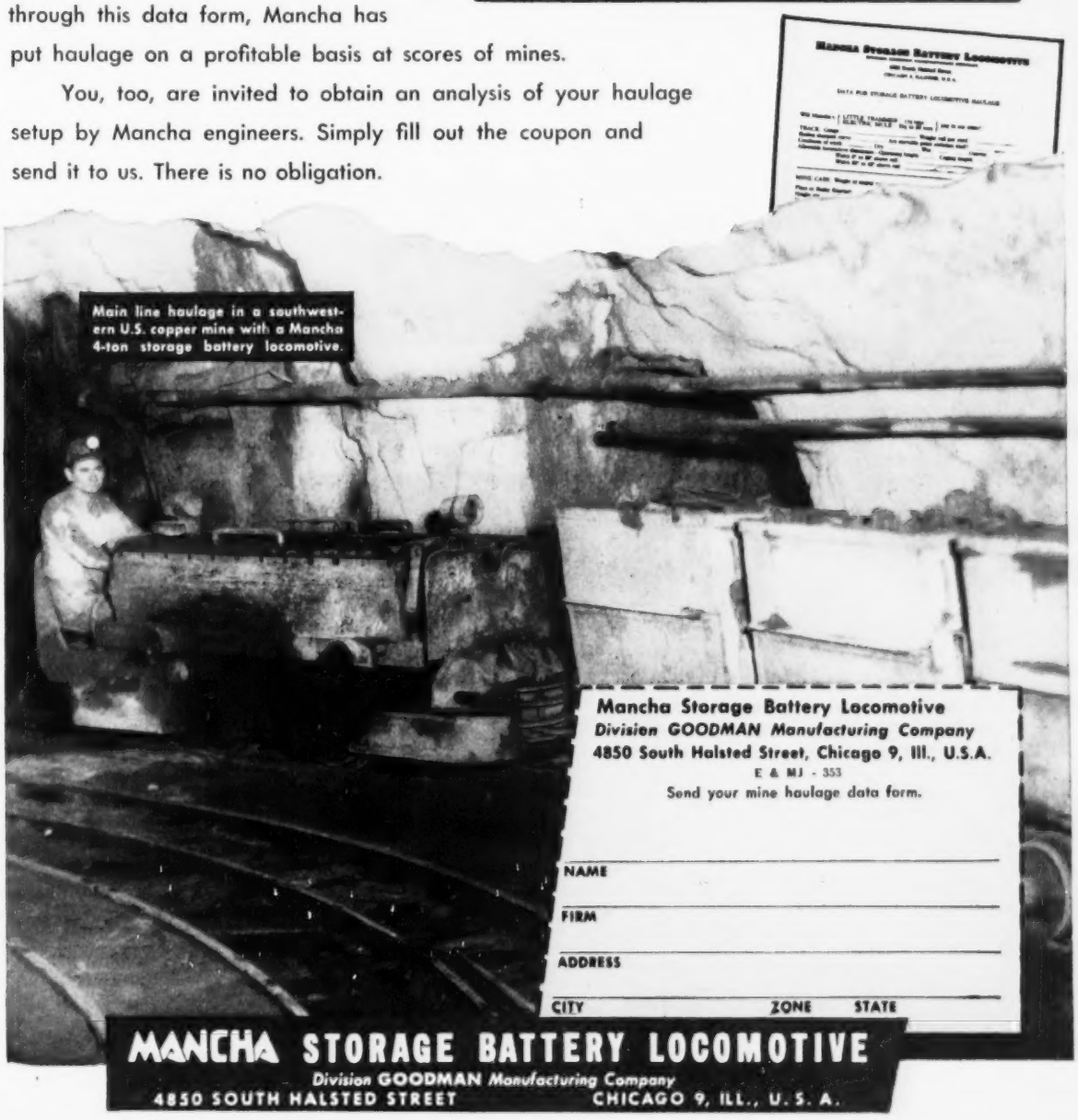
Storage Battery Locomotive

The Mancha haulage data form is a report sheet designed to help us determine the maximum output that can be secured at any mine, with Mancha Storage Battery Locomotives.

Using the information made available through this data form, Mancha has put haulage on a profitable basis at scores of mines.

You, too, are invited to obtain an analysis of your haulage setup by Mancha engineers. Simply fill out the coupon and send it to us. There is no obligation.

Whether or not you intend to buy today—send for our mine haulage data form . . .
Get the answer now!



Main line haulage in a southwestern U.S. copper mine with a Mancha 4-ton storage battery locomotive.

Mancha Storage Battery Locomotive
Division GOODMAN Manufacturing Company
4850 South Halsted Street, Chicago 9, Ill., U.S.A.
E & MJ - 353
Send your mine haulage data form.

NAME _____

FIRM _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

MANCHA STORAGE BATTERY LOCOMOTIVE
Division GOODMAN Manufacturing Company
4850 SOUTH HALSTED STREET CHICAGO 9, ILL., U. S. A.

Tournarocker turns 90° in 12'4" radius, spots fast despite restricted quarters on quarry ledge . . . with 5 to 6 passes from loader gets 7 heaped yds. in 2 to 3 min.

At hopper, Tournarocker dumps entire load in average of 15 seconds. Rig operates 10 hours per day, 6 days per week, supplies 100% of Olaton crusher requirements.

this application whips tight quarters of Kentucky pit

Fort Hartford teams D Tournarocker with front-end loader

To speed limestone delivery from a new hillside quarry to their crusher at Olaton, Fort Hartford Stone Quarry of Hartford tried teaming a highly-maneuverable D Tournarocker with a 1¼-yd. front-end loader. This team worked so successfully in the cramped quarters of the quarry ledge, that the 9-ton "D" now supplies 100% of crusher requirements. Here's typical production:

52½ bank yds. hourly on 300′ haul

With 7′ loading height and low rear entry, Fort Hartford's Tournarocker is heaped with 7 yards of shot rock in 2 to 3 minutes. Short 300′ one-way haul to crusher takes only 20 seconds . . . dump, return, and spot, from 1 to 1½ minutes . . . complete 600′ cycle, 4 minutes. Output per 50-minute hour averages 12½ loads or 52½ bank yards (40% voids). To minimize spotting time in the highly restricted loading area, the mobile, electric-control Rear-Dump unit turns 90° within a radius of 12′4″.

"Thoroughly sold," says President

"We're thoroughly sold on the Tournarocker," says A. C. Hall, President of Fort Hartford. "It maneuvers well on our works where tight quarters are the general rule. We like it very much." The Company, a subsidiary of Fort Hartford Coal Company, also uses their "D" to haul overburden. Their year-around operation clearly demonstrates that the 9-ton D Tournarocker can be profitably loaded with small front-end loaders.

To find out how versatile rear-dump Tournarockers can add to *your* profits, have your LeTourneau Distributor show you owner-verified reports on work similar to your own. Ask him how Tournarocker's many revolutionary features can help increase your production . . . provide greater operating safety . . . and lower maintenance costs. There's a size to fit your needs . . . 9, 18, 35, or 50 tons.

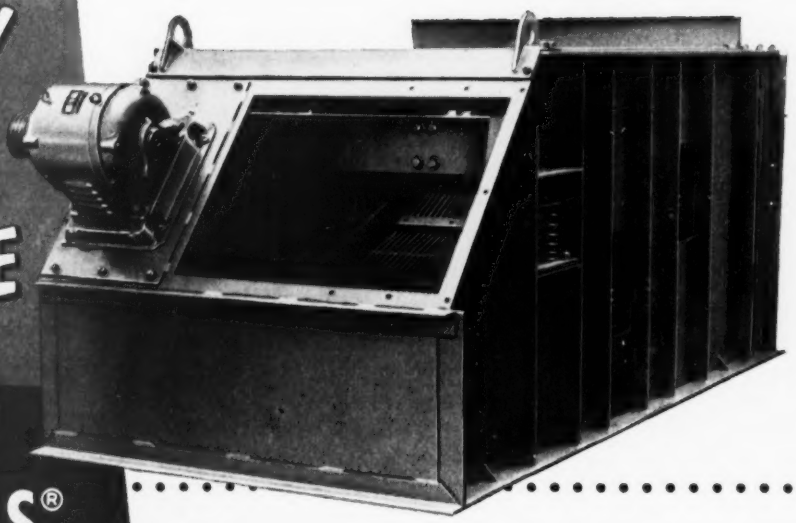
High-speed, rubber-tired excavating hauling • lifting equipment

R. G. LeTOURNEAU, INC., Peoria, Illinois

7′ loading height and low rear entry speed loading . . . 3-ply steel-grid bowl takes shocks of loading big-chunk limestone, requires minimum patching and welding.

Hauling from pit to crusher, Tournarocker's 4-wheel Multi-disc air brakes provided sure control at all times. Unit safely worked over 16% grades while stripping overburden.

FOR HEAVY DUTY SERVICE

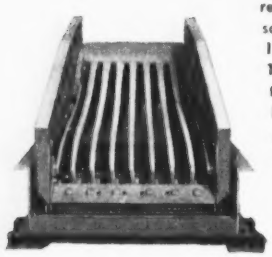


...use the SYMONS® ROD GRIZZLY

THE Symons Type K-RG vibrating Rod Grizzly is built for heavy duty service in handling large tonnages of dry, wet, sticky or gummy ores and rock. Here are some of the important features that have been incorporated into the Symons Rod Grizzly:

- *Heavy duty construction throughout . . . built to handle large tonnages under severe operating conditions.*
- *Abrasion resistant spring steel rod screening surface.*
- *Long lasting, low cost rods are easily adjusted or replaced.*
- *Effective, vigorous vibration provides thorough scalping. Amplitude of vibration can be quickly and easily changed to meet various operating conditions.*

This grizzly is ideally suited for service following most sizes of primary crushers and scalping operations requiring separations at ¾" or larger.



The Symons Bar Grizzly is recommended for large tonnage scalping where clear spacings of 1½" and larger are permissible. The powerful vibrating action of the Bar Grizzly makes it particularly effective for wet, sticky or gummy materials. The sloping, curved bars of the Symons Bar Grizzly tend to tumble the material as it passes over the screening surface. The tumbling action effectively assists in separating the undersize.

For full details about the SYMONS ROD GRIZZLY, send for your copy of BULLETIN 207.

NORDBERG MFG. CO., Milwaukee, Wisconsin

S153

SYMONS . . . A Registered Nordberg Trademark Known Throughout the World

SYMONS GYRATORY CRUSHERS

SYMONS CONE CRUSHERS

MINE HOISTS

SYMONS "V" SCREENS

GRINDING MILLS

DIESEL ENGINES

NORDBERG

MACHINERY FOR PROCESSING ORES and INDUSTRIAL MINERALS

NEW YORK • SAN FRANCISCO • DULUTH • WASHINGTON • TORONTO

MEXICO, D.F. • LONDON • PARIS • JOHANNESBURG

Refining of copper and precious metals takes advantage of STAINLESS STEEL'S corrosion resistance

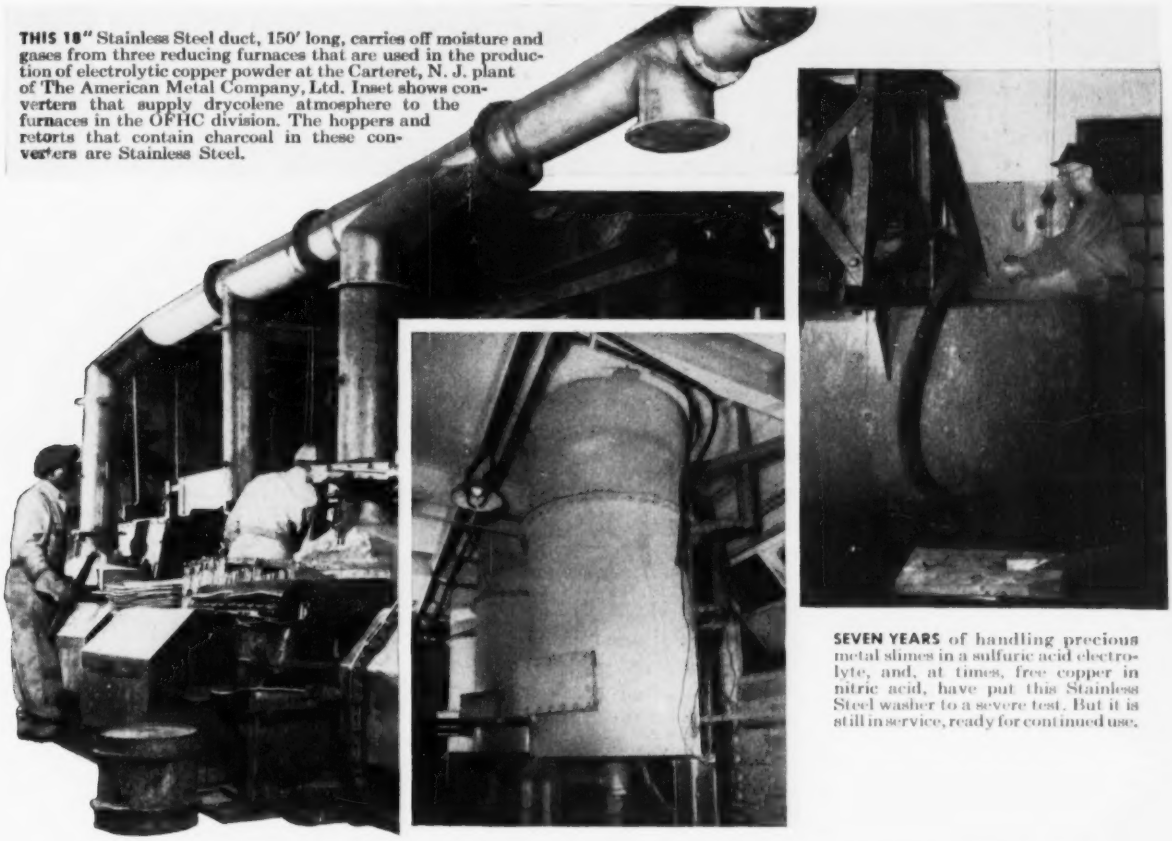
THE Carteret, N. J. plant of The American Metal Company, Ltd.—one of the largest custom smelting and refining operations in the country—puts corrosion-resisting, long-lasting Stainless Steel to good use in several key spots in its processing cycle.

Slimes containing precious metals from the electrolytic copper refining tanks are washed in a Stainless Steel washer. The "mud" is received from the plating tanks in sulfuric acid electrolyte, 200 grams per liter in strength, and is washed out with hot water at 180°F. At times, a surplus of free copper in nitric acid is directed to the washer. In spite of such severe service, the Stainless washer has been in operation seven years.

Stainless Steel lorries are replacing mastic-lined carts in the silver department. Crystals in 2% nitric acid are put into the carts from Balbach-Thum cells. The Stainless carts have been in service three years without sign of wear while the mastic-lined carts required repairs at four-month intervals.

Stainless Steel hoppers and retorts hold the charcoal that furnishes the drycolene atmosphere for use in the furnaces that produce OFHC copper. Charcoal in the three drycolene converters is held at 1900°F. continuously. The reducing furnaces in the copper powder division are equipped with a Stainless Steel duct to carry off atmospheres consisting of 12% hydrogen, 10% carbon monoxide, 12% carbon dioxide and 66% nitrogen and sulfuric acid.

Stainless Steel's exceptional corrosion resistance, its dense, smooth surface, its long, trouble-free service life, fit it for a wide variety of jobs in the metal mining and refining industries. Take advantage of its benefits, and when you do, insist that your equipment manufacturer use perfected, service-tested U·S·S Stainless Steel.



THIS 18" Stainless Steel duct, 150' long, carries off moisture and gases from three reducing furnaces that are used in the production of electrolytic copper powder at the Carteret, N. J. plant of The American Metal Company, Ltd. Inset shows converters that supply drycolene atmosphere to the furnaces in the OFHC division. The hoppers and retorts that contain charcoal in these converters are Stainless Steel.

SEVEN YEARS of handling precious metal slimes in a sulfuric acid electrolyte, and, at times, free copper in nitric acid, have put this Stainless Steel washer to a severe test. But it is still in service, ready for continued use.

UNITED STATES STEEL CORPORATION, PITTSBURGH · AMERICAN STEEL & WIRE DIVISION, CLEVELAND · COLUMBIA GENEVA STEEL DIVISION, SAN FRANCISCO
NATIONAL TUBE DIVISION, PITTSBURGH · TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. · UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

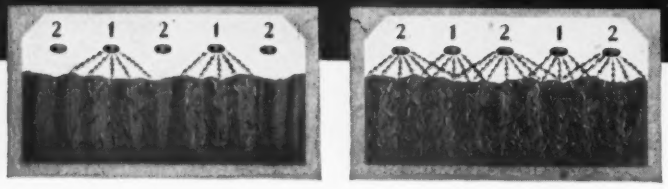
U·S·S STAINLESS STEEL

SHEETS · STRIP · PLATES · BARS · BILLETS · PIPE · TUBES · WIRE · SPECIAL SECTIONS

2-1983

UNITED STATES STEEL

Here's how ROCKMASTER® gives better breakage



The first delays put the rock under stress. Then the number two punch of the second delays cuts across the lines of force at points of maximum stress giving maximum breakage.

THIS unusual sequence of photos shows explosives force, first swelling and then bursting a solid face of granite. It is visual evidence of the excellent breakage possible with the ROCKMASTER blasting system used in an alternate pattern.

Theory behind the breaking action of this pattern is that the first delays, detonating within definite limits of controlled timing, place the entire burden under stress. Then at the moment of maximum tension the second delays, also firing with controlled timing, throw the second punch which produces a wedging and bursting action throughout the burden. The explosives gases of alternate ROCKMASTER blasting can be kept under prolonged confinement, reducing both air blast and ground vibration to a minimum.

Alternate action cannot be duplicated by progressive milli-second delay firing methods or by any form of top detonation.

If you want to see how others have profited by using ROCKMASTER milli-second delay detonators with the ROCKMASTER system of explosives choice and loading methods, send for your free copy of the 20-page book on the ROCKMASTER "16" Blasting System.

ATLAS

ATLAS EXPLOSIVES

"Everything for Blasting"

ATLAS POWDER COMPANY, WILMINGTON 99, DELAWARE

Offices in principal cities

Put This Cost Cutting Specialist on Your Haul Roads

Allis-Chalmers Model D

WEIGHT — 8,800 lb.
BRAKE Horsepower 40
SPEEDS — Four forward, to 25.6 mph., reverse to 3.3

THE Allis-Chalmers Model D Motor Grader offers big-grader design and performance advantages. Like big graders, it has tandem drive wheels to provide real earth-moving traction. It also has a shock resistant tubular frame, high throat and axle clearance, ROLL-AWAY moldboard and power hydraulic controls.

And the Model D has many additional advantages for haul road maintenance. Its low original cost — only a third as much as large graders — its operating economy, size and dependability, make it ideal for this type of work. With the famous Allis-Chalmers 40 hp. gasoline engine, it easily handles all maintenance and light construction jobs. Compactness and short turning radius enable it to work easily in close quarters.

Special attachments — such as the rear-end loader — make it an all-round performer.

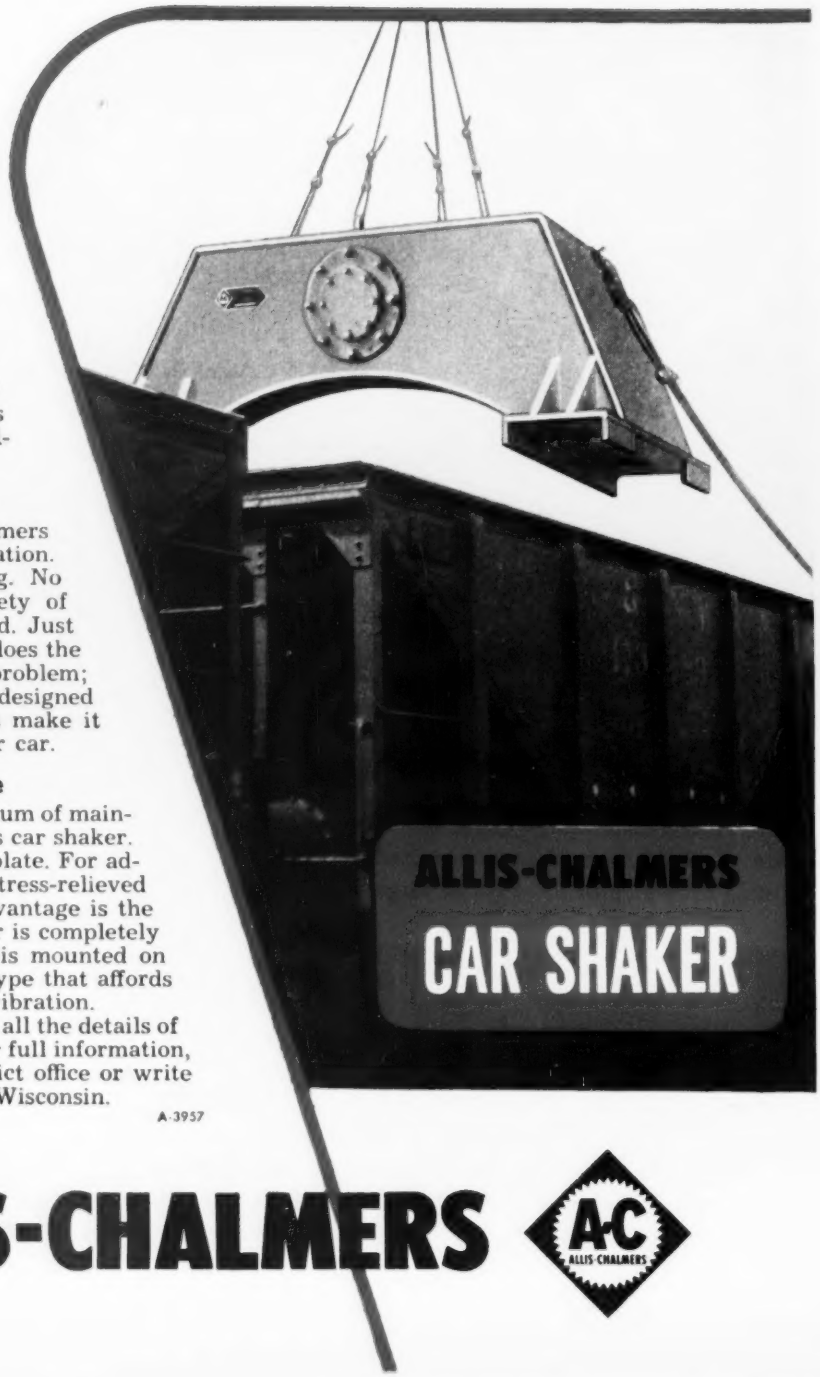
See your Allis-Chalmers dealer for all the facts on the low-cost Model D. Start cutting haul road maintenance costs now.

You can count on the Model D to do *more* than maintenance work, for this busy machine has power and traction to handle a good deal of the construction work, too. In addition, its ⅝ cu. yd. bucket loads excess dirt, fills small gullies and ditches . . . handles many other jobs which would ordinarily call for a specialized machine.

ROLL-AWAY is an Allis-Chalmers trademark.

ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

CUT UNLOADING COSTS



You can save time and money using Allis-Chalmers car shakers for unloading cars. Here are two examples: **(1)** You can unload cars of wet sand or like materials in 1½ to 2¼ minutes; **(2)** you can unload coal in 1 to 6 minutes, depending on surface moisture.

In fact, you can unload any material in minutes, even if it is damp, compacted or in a partially frozen condition.

One-Man Operation

Best of all, using an Allis-Chalmers car shaker is a one-man operation. No more pounding or digging. No more worrying about the safety of men inside cars being unloaded. Just press a button; the car shaker does the rest. There is no positioning problem; Allis-Chalmers car shakers are designed to hang level, and wide shoes make it easy to engage any size hopper car.

Low Maintenance

You'll get long life and a minimum of maintenance with an Allis-Chalmers car shaker. Sides and top are heavy steel plate. For additional strength, the body is stress-relieved after welding. Another big advantage is the power arrangement. The motor is completely enclosed in the body. And it is mounted on rubber shear mountings of a type that affords maximum protection against vibration.

It will pay you to investigate all the details of Allis-Chalmers car shakers. For full information, consult your nearby A-C district office or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3957

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

Stocks of Bethlehem wire rope are usually no farther away than your telephone. Warehouse facilities are geared for high-speed service on emergency calls.

Heading your way in a hurry

Ever had a job stalled by a sudden emergency need for wire rope? A job where every hour, every minute, counted?

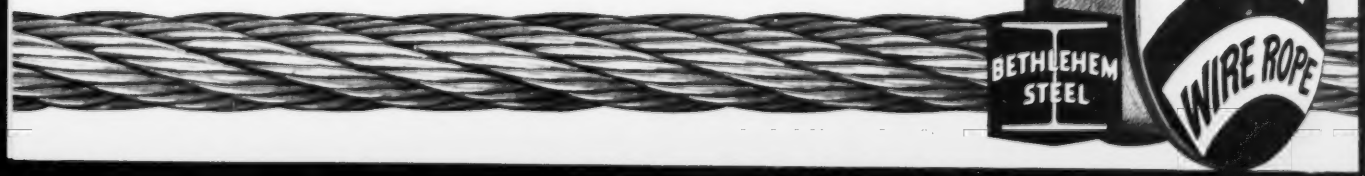
Those things happen. And when they do it's good to know that you're always near a Bethlehem mill depot or distributor. Through a large, quick-acting distribution system, Bethlehem makes it easy to get the rope you need . . . the proper size, type, and grade. Whether you're out in the sagebrush or working a job in the heart of the city, you're never very far from a large, convenient warehouse supply.

So put in a call, outline your needs, and the Bethlehem rope you want will soon be heading your way. Sound, dependable rope. There's none better. And there's no better, friendlier service than Bethlehem and its hundreds of distributors can offer you.

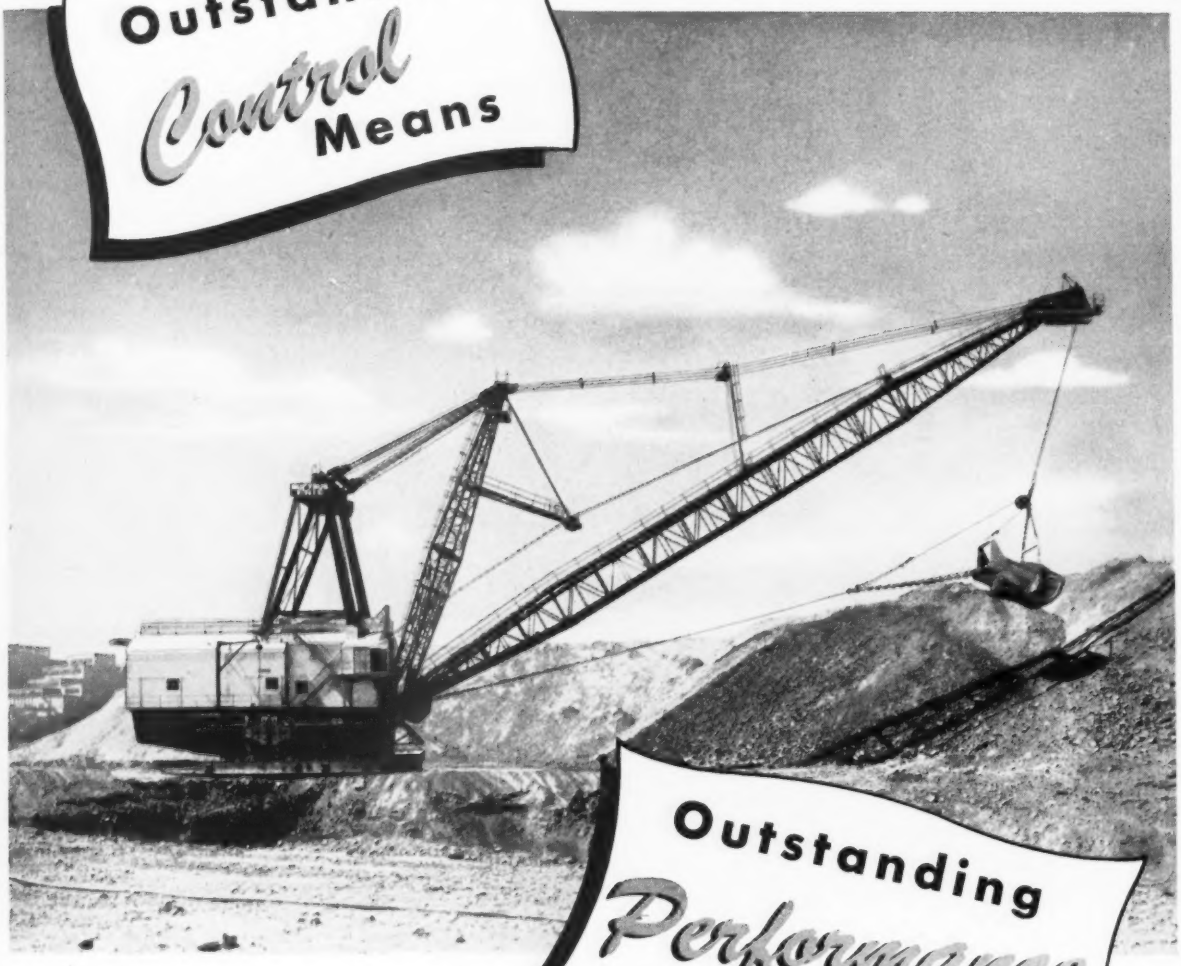
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

When you think WIRE ROPE . . . think BETHLEHEM



Outstanding Control Means



Outstanding Performance

EXCLUSIVE improvements in the Ward Leonard rotating control system on Bucyrus-Erie walking draglines provide the excellent speed-torque characteristics that make this control ideal for big output on mining operations.

Small "pilot" exciters regulate, through exclusive Bucyrus-Erie features, the output of the main exciters . . . the field current to the DC generators. The results are exceptionally fast response, quick acceleration and deceleration of the driving motors . . . effectively speeding up the over-all operating cycle and thus increasing output.

This contact-free variable voltage control system also helps reduce electrical and mechanical maintenance. Combined with heavy-duty milltype motors and efficient motor-generator units, it provides the finest electrical equipment available. 107L52

BUCYRUS ERIE

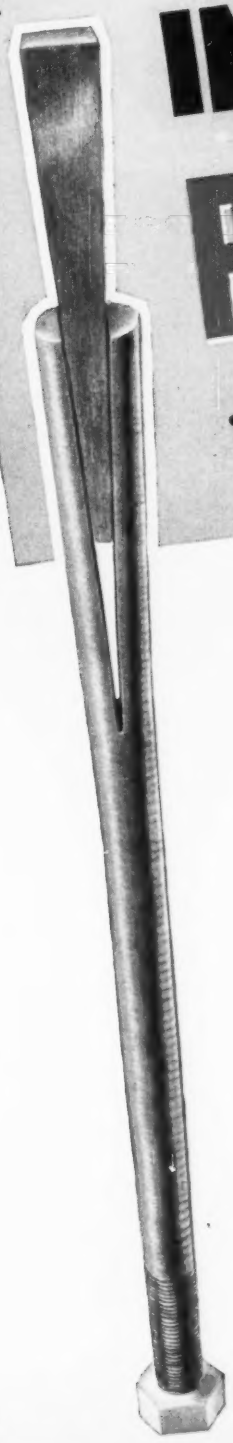
SOUTH MILWAUKEE
WISCONSIN

CF&I

STEEL PRODUCTS FOR THE MINING INDUSTRY

INVESTIGATE ROCK BOLTS

...for your own mining operation



CF&I Rock Bolts for Safety... Economy...Better Housekeeping

CF&I Rock Bolts afford support within a few inches of the face or heading, and blasting has little or no effect on the bolts. They give better support than timbering.

Rock bolts store in less space and greatly reduce handling and transportation costs. They require less work to install – last indefinitely.

Rock bolts provide more clearance overhead and on the sides. Ventilation is improved by the elimination of caps and posts.

Investigate the use of CF&I Rock Bolts for your own mining operation.

CF&I Products for the Mining Industry

Cal-Wic Wire Cloth Screens • Mine Rails And Accessories • Rock Bolts
Wickwire Rope • Grinding Balls • Grinding Rods

THE CALIFORNIA WIRE CLOTH CORPORATION, OAKLAND
THE COLORADO FUEL AND IRON CORPORATION, DENVER AND NEW YORK

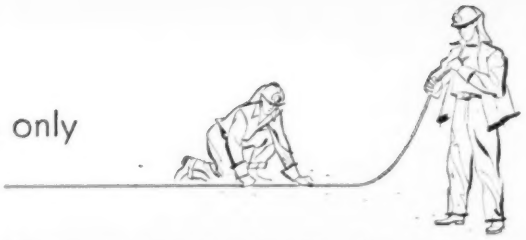
CF&I

ROCK BOLTS

THE COLORADO FUEL AND IRON CORPORATION

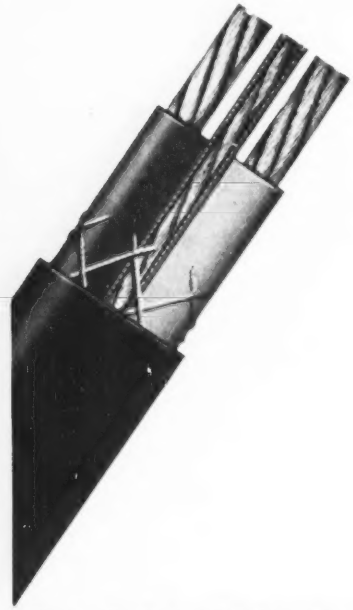
1121

your continuous mining machine is only as "continuous" as the cable that powers it!



Continuous miners produced over 10 million tons of coal last year—and set a record! But it's expensive equipment to lie idle due to faulty cable. Since there's a big difference in cables, it pays to choose yours carefully.

for longer "break-free" service make sure it's



Cold Rubber Insulated **Securityflex**

The *only* economical cable is one that can take the toughest job conditions —impact, abrasion, crushing, cutting, heat, and water—and show a consistent record of fewer time-consuming breaks. In this respect Securityflex* is in a class by itself, doubly protected by cold rubber insulation—an Anaconda first—and rugged neoprene jacket. New flat-twin construction won't override, kink, or twist. Patented "anti-short" breaker strip and flat-stranded ground wire offer safety protection to the cable and *safety-first* protection to mine-operating personnel.

This ANACONDA portable cable stands up well under tension, rides the reel easily, passes smoothly over guides, and won't fatigue readily on frequent sharp bends. Your nearest Anaconda Sales Office or Distributor can demonstrate why this sturdy cable will help boost your tonnage and reduce time out for costly repairs. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

52357 *Trademark

the right cable for the job ANACONDA® **wire and cable**

Smooth starting is important in grinding mills, too!

Traylor Grinding Mills require less power

The starting torque of a machine largely determines its power requirements. In addition, the greatest wear occurs from the time a machine is first started until it reaches its normal operating speed.

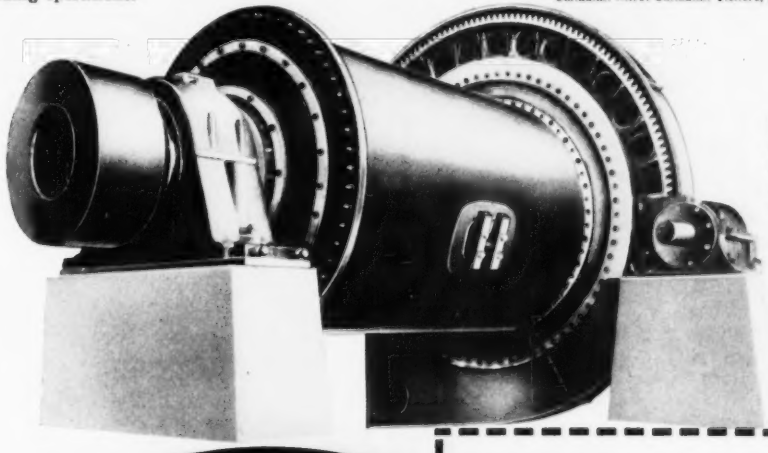
This is very true of grinding mills. Traylor has solved this problem by using main bearings of Meehanite* metal. Each bearing is fitted with a high pressure Alemite pump. This pump coats the trunnion with a film of grease which lifts and floats the mill to overcome high starting torques and eliminates undue wear caused by "dry" starting.

If you have a grinding problem, clip coupon for bulletin 7121. You'll be off to a good start in solving it with a Traylor grinding mill.

TRAYLOR ROD MILLS produce a more uniform granular product than other types of horizontal grinders.

TRAYLOR COMPARTMENT MILLS use a single power source and drive to complete several grinding operations.

TRAYLOR ENGINEERING & MANUFACTURING CO.
533 MILL ST., ALLENTOWN, PA.
SALES OFFICES: New York • Chicago • San Francisco
Canadian Mfrs: Canadian Vickers, Ltd., Montreal, P.Q.



TRAYLOR BALL MILLS grind efficiently to 200, even 325 mesh. Both overflow and diaphragm discharge types available.

A Traylor LEADS TO GREATER PROFITS

Send complete information on Traylor's full line of grinding mills.

Name: _____

Position: _____

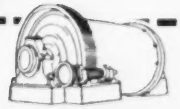
Company: _____

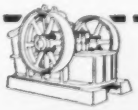
Address: _____ State: _____

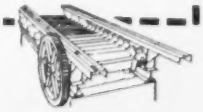
Primary Gyratory Crushers

Rotary Kilns

Secondary Gyratory Crushers


Ball Mills


Jaw Crushers


Apron Feeders

Here's electrical equipment for record-breaking shovel performance!

This Westinghouse-equipped Marion shovel set a new world's record by removing over 1.5 million cubic yards of overburden in just one month at an Eastern coal-stripping operation. In addition, another Westinghouse-equipped shovel at the same mine stripped over 1.3 million yards.

Over a million yards a month averaged during 1951

To attain this average, the shovel moved an average of over 2,000 yards per hour by moving 33.91 cubic yards per pass with an average time of 60.43 seconds per complete cycle. This fast operation is the result of the carefully co-ordinated design of Westinghouse generators, motors and Rototrol® control.

Smooth, controlled operation increases production

The Rototrol control is the "brain" of the shovel operation. When fast action is necessary, as during the swing, Rototrol "forces" the electric drive. The responsive action is quick, fluid and smooth. This prevents any shocks to the equipment and speeds up your operation. Rototrol also makes it impossible to overstrain the machinery. For example, during the crowd operation, the motors will stall out rather than force the bucket and cables.

Dependability of equipment reduces down time

The durability of the equipment is another reason for the record-breaking performance. The Rototrol, for example, is a simple, sturdy device that can be serviced right in the field. The M-G sets have special spherical-sleeve bearings which compensate for misalignment and permit operation even at tilts of 15°. The motors are designed and built to insure maximum durability.

Call Westinghouse on your next project

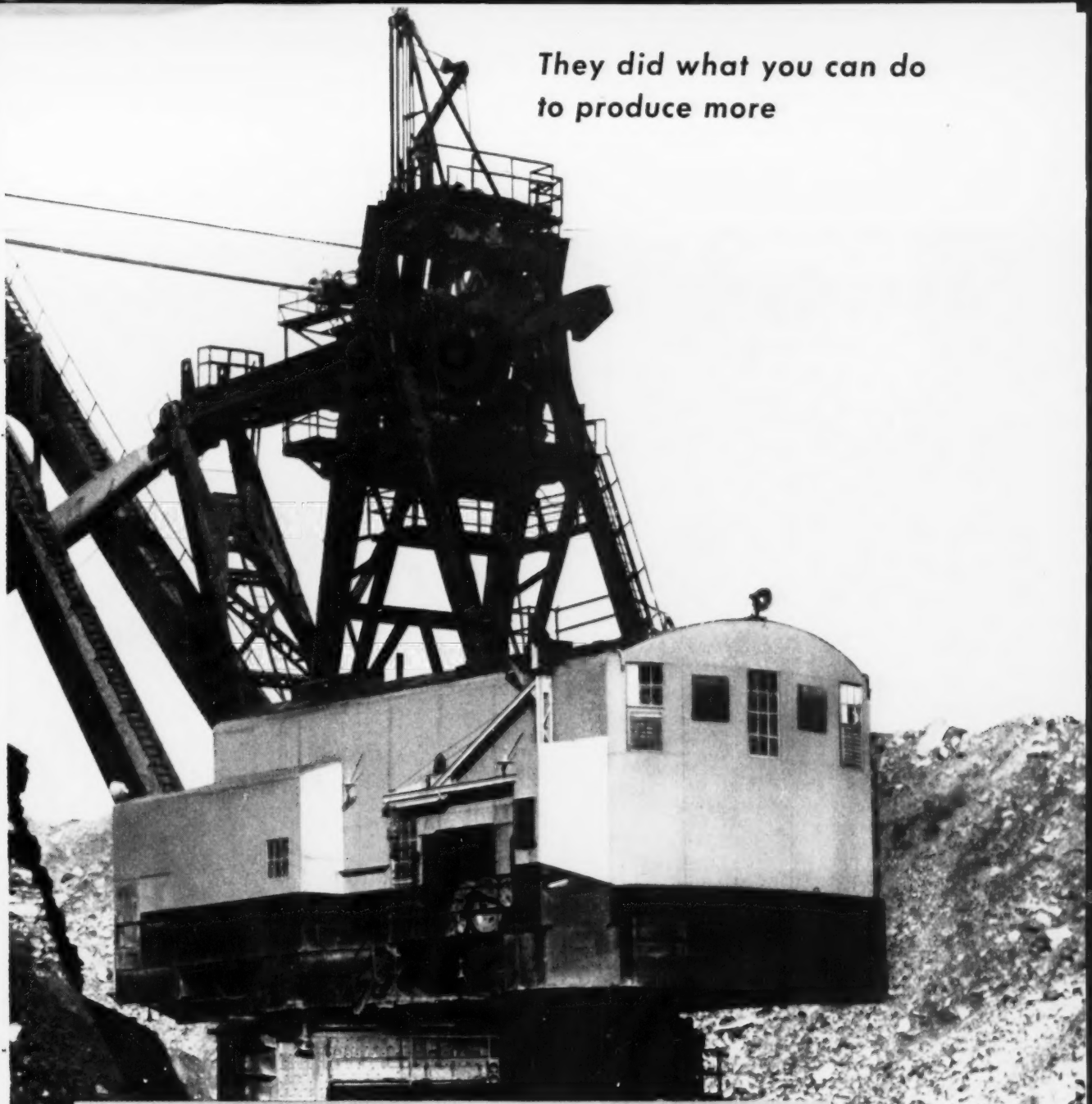
This is a good example of the performance Westinghouse builds into electrical equipment for mining. The next time you're planning a project, call in Westinghouse early. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-94879

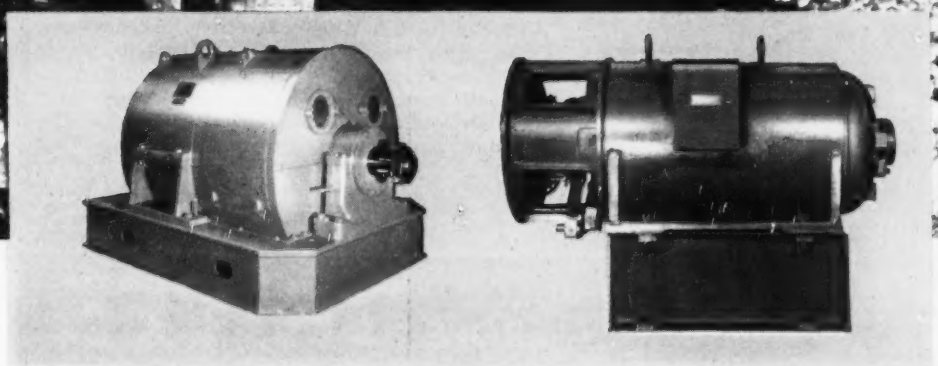
YOU CAN BE SURE...IF IT'S

Westinghouse

EQUIPMENT FOR THE MINING INDUSTRY

They did what you can do to produce more





Westinghouse shovel motors are specially constructed to give you years of continuous operation even under the most rugged conditions. They are designed to help you get the most yardage out of your next shovel or dragline.

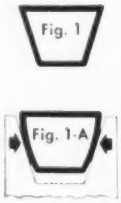
Rototrol is the master intelligence governing the shovel operation. It gives a quick, smooth responsive action to your operator's slightest control movement. This prevents shocks to equipment. The fast action cuts the digging cycle—speeds up production.

WHY

Gates V-Belts Wear Longer-

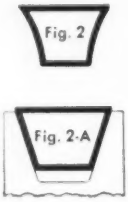
The CONCAVE SIDE (U.S. Patent No. 1813698) is what gives the Extra Wear!

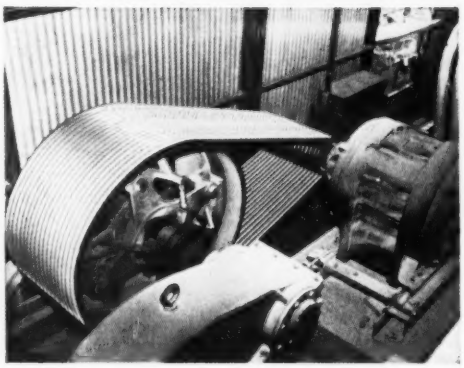
Take any *straight-sided* V-Belt (Fig. 1) and bend it as it bends in going around its pulley. You will clearly see its sides *bulge out* (Fig. 1-A). These sides therefore press *unevenly* against the V-pulley and this causes extra wear at the point shown by arrows (Fig. 1-A).



Now bend a Gates Vulco Rope with CONCAVE SIDES (Fig. 2).

You will see the precisely engineered CONCAVE SIDES fill out to an exact fit in the sheave-groove (Fig. 2-A). The sides press *evenly* against the V-pulley. All wear is distributed *uniformly* across the *full width* of the Gates Vulco Rope—and this means longer belt *life* and *lower* belt *costs* for you.





Typical Gates Vulco Rope Drive—the Gates V-Belts are built with Concave Sides to insure longer belt wear.

When you buy V-Belts, be sure to get the V-Belt with the CONCAVE SIDES—the Gates Vulco Rope!

Gates Engineering Offices and Jobber Stocks are located in all industrial centers of the United States and in 71 foreign countries.

CS-533

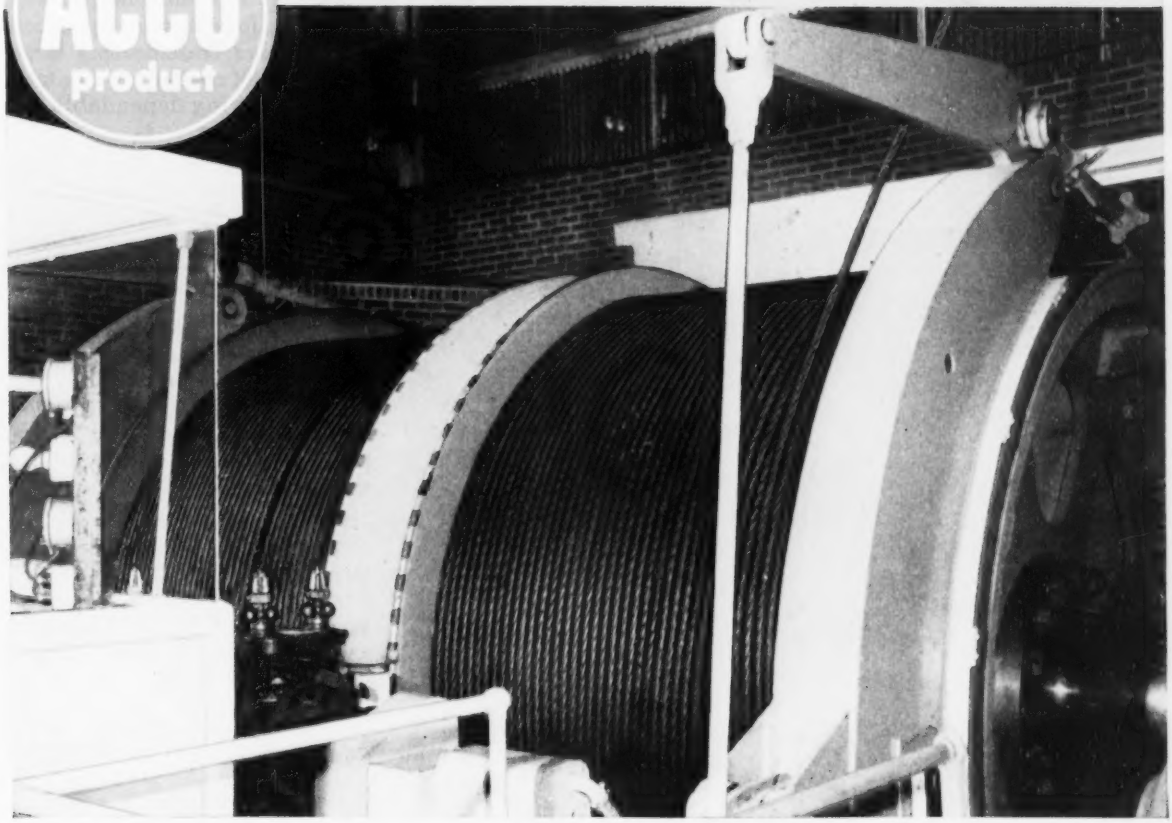
V-Belts—Hose
Molded Rubber Goods
for industry
World's Largest Maker of V-Belts

Gates® VULCO ROPE **DRIVES**

THE GATES RUBBER COMPANY • DENVER, U.S.A.

an ACCO product

TRU-LAY Preformed WIRE ROPE



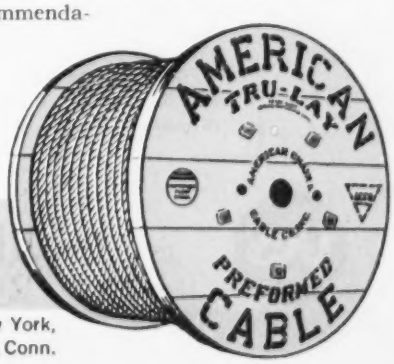
How TRU-LAY Rolls Up Longer Service Records...

● The fine tonnage records set by TRU-LAY mine shaft ropes are due to their particular construction.

For many years AMERICAN CABLE engineers have checked carefully the service life of various constructions of wire rope. They found repeatedly that there is one grade of rope with the exact combination needed for highest strength and resistance to bending fatigue and crushing on the drum. Their experience records show consistently longer life which means lower operating costs.

Before you order your next shaft rope, or wire rope for any other purpose, ask your AMERICAN CABLE distributor to tell you the advantages of TRU-LAY Preformed improved plow steel, the rope identified by the green strand. Let him recommend the correct, long-life construction for your equipment. It will save you money.

Write our Wilkes-Barre office for **DH-128-A** "Wire Rope Recommendations for Mining Industries."



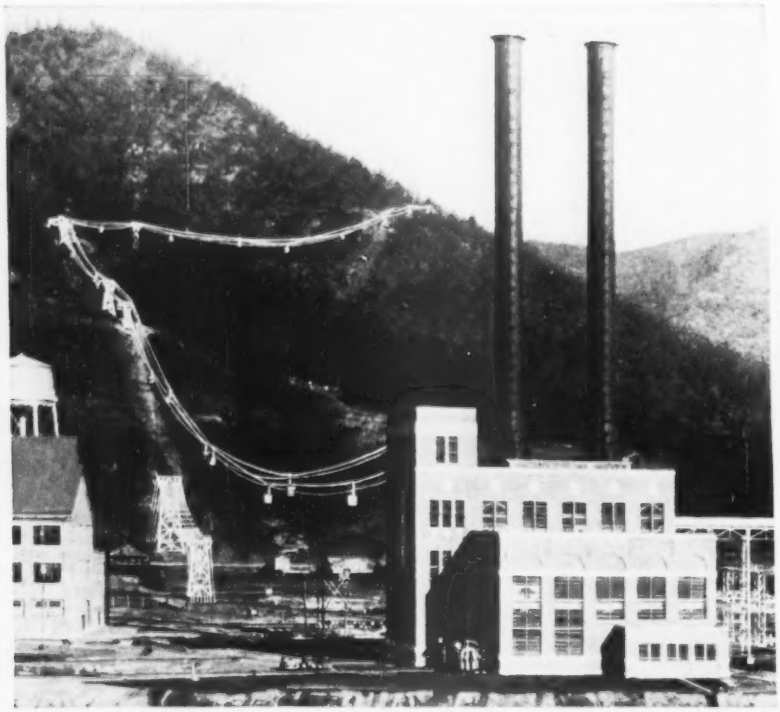
ACCO

TRADE MARK

AMERICAN CABLE DIVISION
AMERICAN CHAIN & CABLE

Wilkes-Barre, Pa., Chicago, Denver, Houston, Los Angeles, New York, Odessa, Tex., Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

Aerial tramways give low-cost transportation

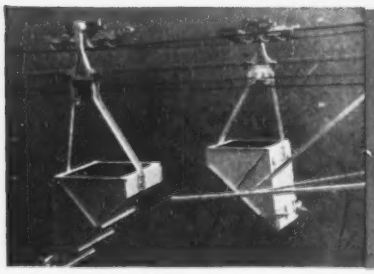


This 8,775 foot bicable tramway has been in continual operation for 23 years, transporting large quantities of coal at low ton-mile cost and giving dependable all-weather service.

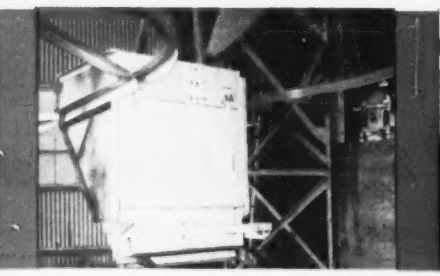
The tramway has two stationary track cables and a traction rope that moves continuously in one direction. Buckets clamp to the moving rope at 205 foot intervals and move at 500 feet per minute.

The 48 cu. ft. end dump buckets load and unload automatically. For loading, buckets detach from traction rope, run on graded rails, and attach again after being loaded. Detaching and attaching are also automatic.

This aerial tramway was designed and installed by the Tramway Division of U. S. Steel at the Alloy, West Virginia, plant of Electro Metallurgical Company, a Division of Union Carbide and Carbon Corporation.



Conveying materials for a few hundred feet or for several miles, Columbia-Geneva Tramways can be built to handle from 1½ to more than 300 tons hourly. They can be designed to meet almost every type of operating condition, and to handle many kinds of commodities easily and economically—from a tray of optical lenses to a carload of lumber.



Load carriers, like this one on a bicable tramway, are available in many different types and sizes. Services of Columbia-Geneva's Tramway Division include designing the tramway...supplying the steel...excavating for foundations and erecting support structures...furnishing and installing all wire rope, cables, and electrical and mechanical parts.

Tramway support structures are of many types, depending on terrain and job. Because of this flexibility, tramways are free of ground contour, roads, railroads, etc., are unhampered by bad weather, and can climb extremely steep grades. Other advantages: loads can be moved without rehandling and rights-of-way are easier to acquire.

Send for this free manual on aerial tramways. Write on your letterhead today to the Tramway Division, Columbia-Geneva Steel, 141 Battery St., San Francisco 6, Calif. Or for an expert study of your transportation needs, ask for the services of a Tramway Engineer. He can show how an aerial tramway would pay off for you, and he can contract for its design and all phases of its construction, including materials.

Tramway Division

Columbia-Geneva Steel

Division United States Steel Corporation

USS

UNITED STATES STEEL

You wouldn't hunt big game with a pea shooter

. . . and with today's lower grade ores, you can't shoot for big production with yesterday's machinery.

TRAYLOR TC GYRATORY is built to maintain profits in expanded production

The extra-heavy construction and exclusive design of the Traylor TC assures greater profits when producing larger quantities of ore. The TC Crusher features Traylor's original, self-tightening bell head and curved concaves. These curved crushing surfaces are the secret of a Traylor TC's huge production and efficient use of power. For instance, a Traylor 42″ TC will produce 1290 tons of 6″ ore per hour on only 275 H.P. Traylor TC Gyratory Crushers are available in 7 sizes. Feed openings range from 20″ to 60″ . . . discharge openings from $1\frac{1}{2}$″ to 9″. Write today for Traylor Bulletin 126 . . . get complete illustrations and specifications.

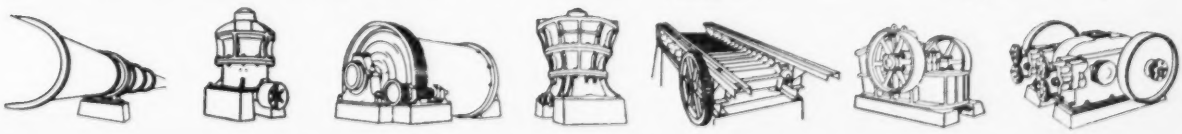
A **Traylor** LEADS TO GREATER PROFITS

TRAYLOR ENGINEERING & MFG. CO.
542 MILL ST., ALLENTOWN, PA.
SALES OFFICES: New York • Chicago • San Francisco
Canadian Mfrs: Canadian Vickers, Ltd., Montreal, P.Q.

Mail this coupon now!

Send me complete facts about the Traylor TC Gyratory. (Bulletin 126)

Name: _____
Position: _____
Company: _____
Address: _____ State: _____



PUMP'S FINE TODAY... BUT HOW ABOUT TOMORROW?

With Rex and only Rex

You're assured new pump efficiency for the lifetime of the pump because . . .

ONLY REX HAS THE ADJUSTABLE AIR PEELER!

Every self-priming, centrifugal pump must have an air peeler to remove air from the suction line and create the vacuum that draws water up to the impeller. Normal wear on the peeler and fast-moving impeller destroys the necessary close clearances between these parts . . . reducing both priming and pumping efficiency.

Here's where *Rex alone* can maintain original priming and pumping efficiency for life. A simple adjustment of the *exclusive Patented Adjustable Air Peeler* and you've restored its original close clearance with the impeller. Just a twist of the wrist and you've restored new pump efficiency . . . for today . . . and tomorrow.

Get all the details on this and other exclusive Rex features from your local Rex distributor or write to Chain Belt Company, 4679 W. Greenfield Ave., Milwaukee 1, Wis.

CHAIN BELT REX COMPANY ®

CONSTRUCTION MACHINERY

FARVAL—*Studies in Centralized Lubrication* No. 139

Farval Announces DC 20 Automatic Pumping Unit

for complete lubrication of smaller machines

NOW any small machine can have a completely automatic system of Farval centralized lubrication—as efficient and economical as the larger systems which have proved so valuable on heavy industrial equipment during the past 26 years.

Chief component of this smaller, low cost system is the new Farval DC20 pumping unit which handles either grease or oil. In addition to the pumping unit, the complete Farval system consists of two main supply lines, the familiar Dualine measuring valves and discharge line connections from measuring valves to the bearings.

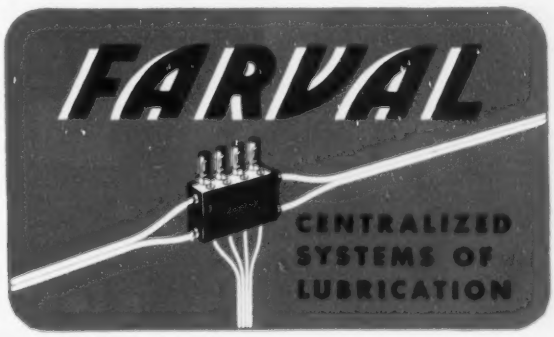
Easily installed at any convenient place on or near a machine, the DC20 insures automatic delivery of lubricant to bearings, as often as needed, in whatever quantities desired, while the machine is in operation. Remember that Farval—and Farval only—employs the Dualine valve that is fully adjustable—simple, sure and foolproof—with a positive indicator which visually signals that the valve has functioned.

Hundreds of operators using the larger Farval automatic systems have discovered that the entire cost of a system is saved the first year. Lubricant savings alone may run as high as 75%.

Investigate the new DC20. Near you is an experienced Farval lubrication engineer who will demonstrate how the new DC20 pumping unit can save time and money and increase production on your present hand-lubricated machines. Write today for a copy of Bulletin 39, "DC20 Pumping Unit for Smaller Machines". The Farval Corporation, 3281 East 80th Street, Cleveland 4, Ohio.

Affiliate of The Cleveland Worm & Gear Company, Industrial Worm Gearing. In Canada: Peacock Brothers Limited.

ALL PARTS OF THIS NEW FARVAL DC20 *automatic pumping unit are assembled on a single base plate ready for quick, easy mounting at any convenient point. Supply lines run from the pumping station to the Dualine measuring valve manifolds, one valve for each bearing to be lubricated. The entire system is installed very simply and at a cost that will be repaid in a few months in savings effected.*

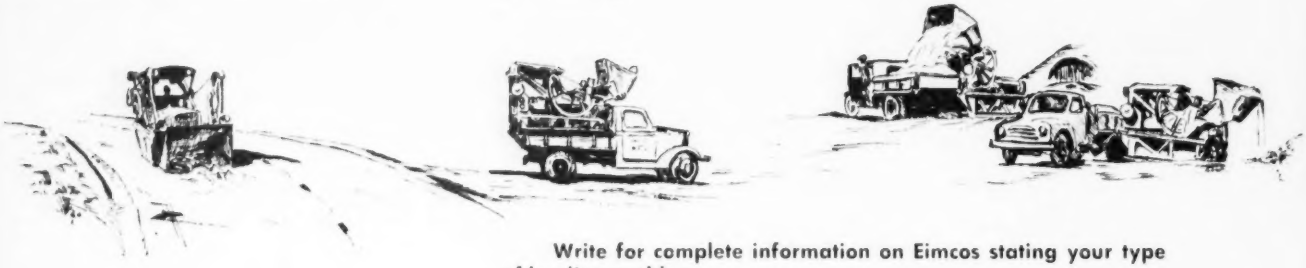


Eimco's Work Faster! Keep Job Costs Lower

Contractors, on all types of jobs, know that Eimco's will consistently save them money as an all around tool on general maintenance jobs, special repair jobs or new construction.

Take a job of loading sand or gravel. Eimco's will load from 4 to 6 yards per minute, and keep it up. This is a loading speed that invites comparison with heavier, more expensive equipment.

Eimco's are also good at digging unbroken ground for new roads, soil-silt deposits in riverbeds, taking up highway curb or shoulders, loading snow, clearing winter sluff, digging out frost blisters or digging ditches culverts or the toughest kind of rock loading.



Write for complete information on Eimcos stating your type of loading problem.

You Can't beat an Eimco

EIMCO

4437

THE EIMCO CORPORATION

The World's Largest Manufacturers of Underground Rock Loading Machines

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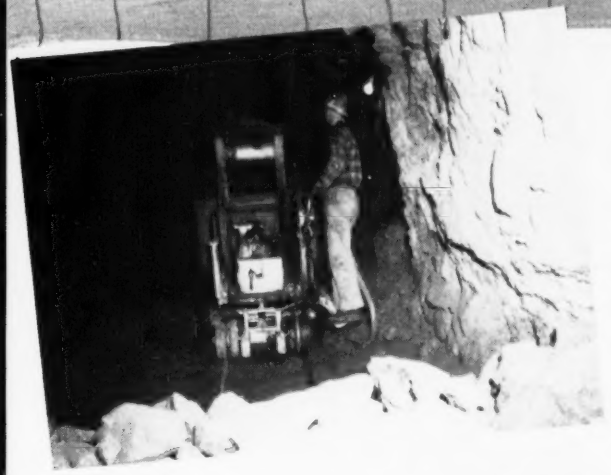


EIMCO'S
"AT HOME" UNDERGROUND

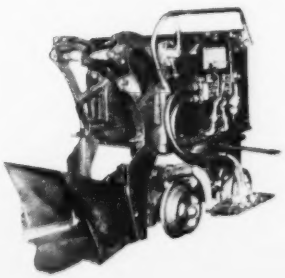
Small and large mining companies have found that Eimco loaders are best. They cost less to maintain, they're faster, more efficient and the operators prefer to run them.

Eimco's, have a number of other advantages. They were designed to be "at home" underground. In tunnels where going is tough you'll find Eimco's more dependable. In mines where production by drawhole mining is practical you'll find Eimco's more economical. In the Uranium country, when its often desirable to sink an incline to the level of the ore body, you'll find Eimco's the only choice as they're as much at home on a slope as they are in level mining.

Write for more information on versatile Eimco loaders.

Eimco 12B Loader operating on slope and (below) operating on level ground in Uranium mine.

At right — Eimco 12B — Smallest mechanical loader — Economical, fast and versatile.



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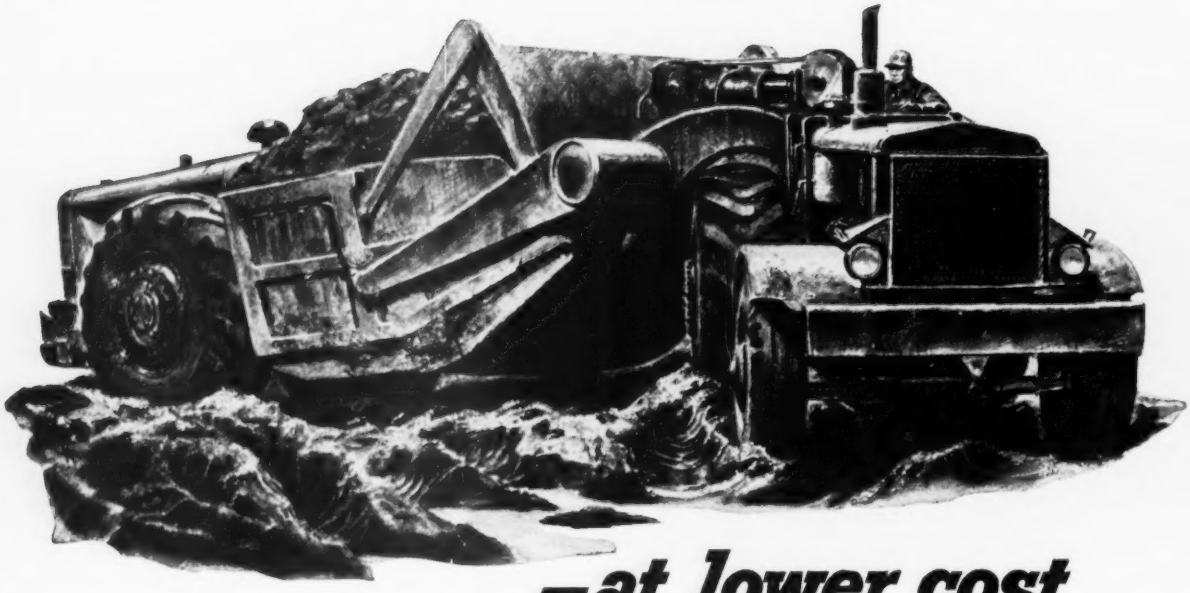
Moves big payloads faster



—at lower cost

BIG earth-moving vehicles like this twin-engine self-loading scraper get more work done faster because of Allison TORQMATIC DRIVES. These time-proved hydraulic drives — more than 10,000 have been built for Army tanks and heavy-duty vehicles—make multiple engine applications possible —and practical.

TORQMATIC DRIVE provides a smooth, steady, oil-cushioned flow of power—high-starting torque with uninterrupted acceleration —protection against shock-load damage to engines and equipment. It eliminates engine lugging and stalling while maintaining power to drive wheels at all times. This permits the engine to operate in its most effective speed range by balancing engine power with load requirements.

Users of trucks, scrapers and other vehicles equipped with TORQMATIC DRIVE *report up to 30% more work done and 15% less cost per yard than with a mechanical drive* — additional good reasons why engineers are designing Allison TORQMATIC DRIVES into all types of heavy-duty equipment.

Allison TORQMATIC DRIVES are the only heavy-duty full torque-shifting vehicle transmissions available today—engineered for compactness, permitting flexibility of drive-train design for today's and tomorrow's vehicles.

Like to know more about TORQMATIC DRIVES? Write us for Engineering Data Bulletin which gives full specifications.

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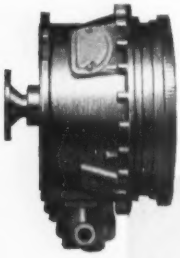

Compact, efficient hydraulic drive for . . .

CRANES TRACTORS TRUCKS SHOVELS LOCOMOTIVES DRILLING RIGS

It's a Fact!

JOY AXIVANE® MINE BLOWERS

produce more air per horsepower

You don't have to make complicated tests to check the efficiency of Joy blowers. Just compare the performance data listed in Joy Bulletin No. J-607 with the published performance data of conventional mine blowers. That will give you positive proof that the mechanical efficiency of Joy blowers is unexcelled for high or low pressure operations.

Moreover, the pressure range in which AXIVANE blowers operate with unequalled efficiency is so wide that it is totally unnecessary to have one type of blower for short lengths of tubing and another type for longer lengths. The Joy AXIVANE mine blower will operate through any length of tubing with high efficiency.

Five sizes, ranging from ½ to 5 H.P., make up the series. For greater duties, AXIVANE fans from 5 to 3000 H.P. are available.

● *For complete data, write for Bulletin J-607.*

AERODYNAMIC DESIGN

The blades of Joy blowers are of airfoil shape, similar in cross-section to an airplane wing. Rotors are of cast-aluminum construction, permitting accurate adherence to the design shape. Both the number and shape of the blades and stationary vanes are mathematically determined to insure greatest efficiency. The minute clearance between blade-tip and blower casing eliminates most tip loss, a common cause of fan inefficiency and noisy operation.

VANEAXIAL CONSTRUCTION

Joy blowers have stationary vanes to recover the rotative energy imparted to the air by the rotor. The airflow from AXIVANE blowers is therefore substantially axial. The unequalized outlet pressures of all other fan types create non-axial, turbulent airflow, which is wasteful of power. Joy blowers consequently give you a more favorable electric-to-air-power ratio, and are relatively quiet in operation.

Consult a Joy Engineer

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JOY MANUFACTURING COMPANY

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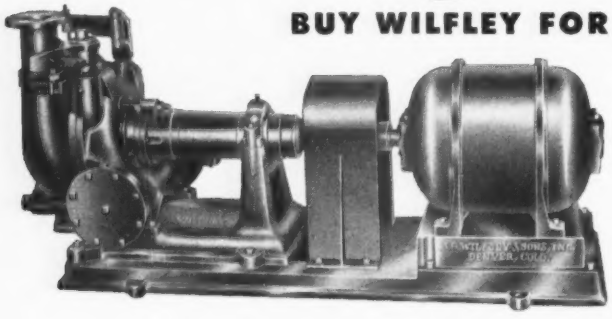
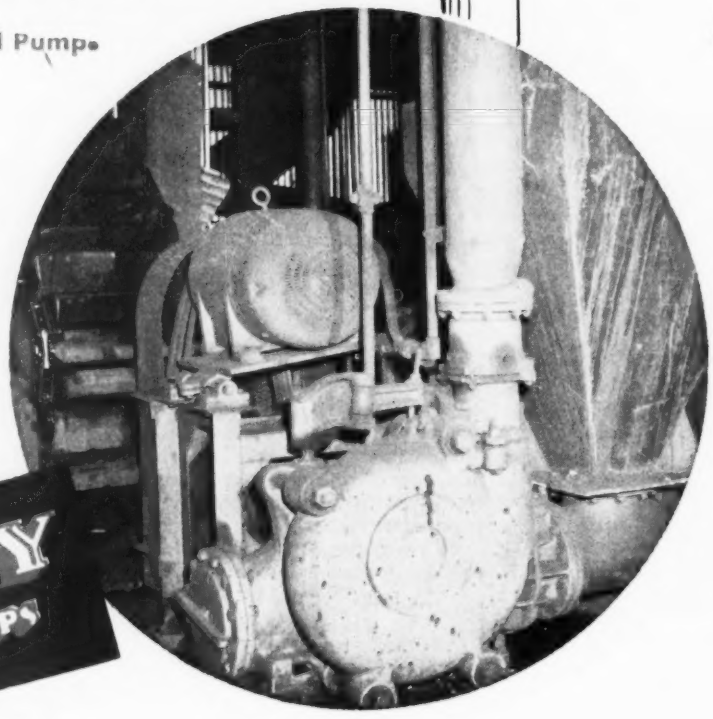
heavy media

BUY WILFLEY FOR COST SAVING PERFORMANCE



Companion to famous Wilfley Acid Pump

This Wilfley Model K *pump is extremely effective in heavy media circuit and thickener circuit work in coal washing operations. Specifically designed for rugged, heavy duty performance, delivering continuous, trouble-free operation at low cost without media loss, leakage or dilution.*



WILFLEY centrifugal PUMPS

In modern plants all over the world dependable, highly efficient Wilfley pumps are on the job, operating 'round-the-clock without attention. Available in sizes that meet every pumping requirement. Individual engineering on every application...Write or wire for complete details.

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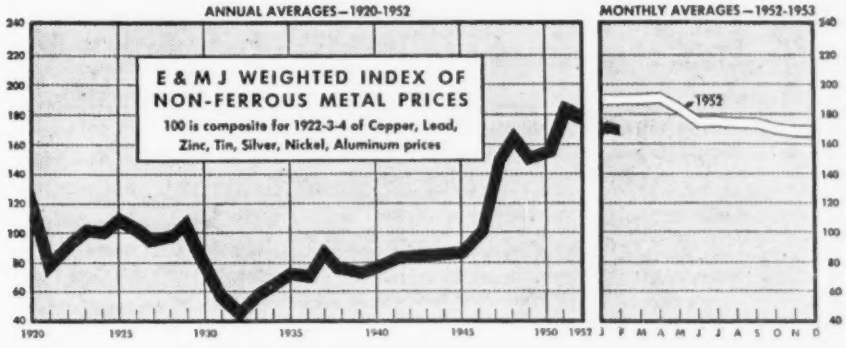
E&MJ OUTLOOK

PRICES



MARKETS

The price of copper, as predicted, leaped upward as soon as controls were relaxed, but the upturn came too late in the month to influence the *E&MJ* index of nonferrous metal prices. Lower lead and zinc averages, cut the index for February to 172.29 from January's 172.82.

Continued weakness in lead and zinc in London had people here wondering if, under present disturbed conditions, that market gives a true picture of values in metals. With exchange problems still restricting free movement of commodities, ordinary supply-demand relationships don't have a chance. Yet London traders still hope to start trading in copper on the London Metal Exchange before the summer's out.

•

LABOR

It looks like a battle over wages this summer, in copper at least. Mine, Mill leaders are worried more than they'll admit over raids by CIO and AFL unions, and they don't like greater wage boosts won by other unions.

•

AT HOME

Businessmen throughout the nation seem concerned only about how to increase production. Auto builders, for example, are headed for better than a six-million-car year at present rates. Their customers, apparently believing in election promises of tax cuts, are spending, and borrowing heavily in the process. Another war scare could easily touch off another round of inflation with upswings in prices of stocks, real estate, and commodities.

Barring war scares, however, this situation holds dynamite. Unless businessmen and consumers wake up fast, there'll be an "inventory recession" late this year that would be hard to stop.

Copper decontrol came in by the back door. Washington decontrolled copper scrap, then woke up to the fact that primary metal had to go along. It may take months to stabilize the copper market; the domestic spread being between 27¢ and 32¢ per lb. The weight on the low side is from those companies facing a tough wage negotiation battle this summer.

American Smelting states it has not awarded contracts for construction at its new Toquepala copper project in Peru and is not contemplating such awards soon. Only engineering studies, design and estimation work are now being done.

Research on uranium at University of Michigan shows that putting radioactive palladium in diesel engine metals makes fuel burn at lower compression ratios and greatly increases engine efficiency.

Inland Steel is going ahead with development of a Steep Rock, Canada, iron orebody carrying 50-million tons of proven ore and as much more possible ore, said to be high grade. It will be a $50-million job. (See p. 126.)

MARKETS—Trends and Prices

Copper Decontrolled by OPS; Domestic Price Begins to Rise—Slab Zinc Reduced to 11¼¢

DECONTROL of the price of domestic copper on Feb. 25 dwarfed all other developments in nonferrous metals during the last month. Quick action was forced on the Office of Price Stabilization after market conditions became chaotic as a result of an order that removed all restrictions on nonferrous scrap, including copper scrap, on Feb. 12. For a time, prices named on scrap actually rose to a higher selling basis than those maintained on the primary product.

At a meeting of the advisory committee on primary copper with NPA officials, held Feb. 18, members of the group declared that revocation of price control on scrap without similar action on domestic primary copper is creating an intolerable condition which should be corrected promptly. Though the group also asked NPA to end allocation of copper, that part of the program was retained for March, even though it may prove unworkable under the new free-pricing setup.

The Copper-Zinc-Lead Committee of the International Materials Conference agreed to discontinue first-quarter allocation of primary copper, effective Feb. 15, 1953. Though need for further international allocation appears to be unlikely, the committee intends to review the supply position of copper again in March.

President Eisenhower signed the measure that suspends the import tax on copper on Feb. 14. It will remain suspended until June 30, 1954 providing the domestic price does not drop below 24¢ a lb.

OPS exempted some 18 commodity groups from price control, including iron ore, ferrous and nonferrous scrap, copper, lead, zinc, tin, antimony, cadmium, aluminum, magnesium, silver, selenium, and most of the minor metals and minerals. Excepting copper, and to some extent aluminum, the action on prices caused hardly a ripple in most of the items now in ample supply.

Price Movements Mixed

Domestic copper began to rise in price as soon as the news got out that decontrol had become a fact. However, the rise in copper occurred late in the month and failed to offset lower monthly averages for lead and zinc. The *E&MJ* price index declined from 172.82 in January to 172.29 in February. Continued pressure on foreign prices of lead and zinc unsettled the domestic market for these metals, the latter falling to 11¼¢, East St. Louis, on the common grade, a new low for the movement. Foreign silver was firm but unchanged at 85¼¢ an oz. troy all month. Quicksilver prices declined as buyers withdrew from the market on indications that the supply situation has improved.

Use of all metals continued at a relatively high level. The Federal Reserve Board's index of production averaged close to 237% of the 1935-39 base period during the first two months of the year.

Domestic Copper Advances

That the domestic price would rise as soon as decontrol became official was certain. Most mine operators in this country leaned toward a gradual rise to maintain an orderly market in the transition period. Some operators favored moving the quotation right up to the top level at which the Chilean metal has been pegged under price control of the Chilean authorities, namely 36½¢ Valley. The question asked most frequently was: Will fabricators purchase the metal as freely under a single pricing standard as when domestic metal sold at 24½¢ while the foreign product brought as high as 36½¢?

During the last four days of February, domestic copper sold over a wide range in prices.

Kennecott, leading United States producer, announced that its selling basis on domestic copper will be 27½¢, up 3¢ from the ceiling price imposed by OPS.

Phelps Dodge advanced the price on its mine output to 28½¢, but stated that it would operate its custom smelting division on a competitive basis.

Anaconda took no stand until after the turn of the month when it began pricing its domestic output at 32¢, the level previously established by custom smelters and one small mine operator.

The foreign division of the copper market was deeply concerned over the price outlook here. Unless consumers in the United States continue to absorb the bulk of the world's surplus copper, the entire price structure could weaken, it was argued. Though buyers in this country continued to absorb substantial tonnages of foreign metal throughout February, demand for foreign copper slackened somewhat after price controls were removed. Consumers scrambled for domestic metal at prices below those named on the foreign product.

The Central Bank of Chile made known that it will continue its purchase and sales price for copper. Chile has been selling freely on the unchanged basis of 35½¢, f.o.b. Chilean ports.

Belgian Congo and Rhodesian producers have been holding to the equivalent of 33½¢, f.a.s. New York, on virtually all of their transactions.

Lead Imports Heavy

With imports of lead heavy, and foreign markets unsettled, domestic producers could do no better pricewise than hold to the 13½¢ basis. Demand for lead from domestic consumers was moderately active all month.

Imports of refined lead in 1952 totaled 510,716 tons, which compares with 178,903 tons in 1951. Imports in December alone totaled 82,911 tons, of which 32,043 tons came from Australia, 25,489 tons from Mexico, and 12,937 tons from Canada.

Zinc continued to weaken, falling to 11¼¢ on the Prime Western grade, East St. Louis, a net loss of ¾¢. Sell-

Average Prices for February (E&MJ Quotations)

Copper:

Electrolytic, domestic, refinery	24.968
Electrolytic, export, refinery	34.783

Lead:

Common, New York,	13.500
Common, St. Louis	13.300

Silver and Sterling Exchange:

Silver, New York, per oz.	85.250
Silver, London, pence per oz.	74.000
Sterling Exchange, "Checks"	281.906

Zinc:

Prime Western East St. Louis	11.483

Tin:

New York Straits	121.500
New York, 99% min. (e)	120.500

Gold, per oz. U.S. price	$35.000
Quicksilver, per flask	205.091
Antimony (E&MJ) (d)	37.970
Antimony, bulk, Laredo	34.500
Antimony, in cases, Laredo	35.000
Platinum, refined, per oz.	90.000
Cadmium (a)	200.000
Cadmium (b)	207.500
Cadmium (c)	215.000
Aluminum, 99% plus, ingot	20.500
Magnesium, ingot	24.500
Nickel (f)	60.000

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lbs.

(a) Cadmium average based on the producers' quotations.

(b) Cadmium average based on the average of the producers' and platers' quotation.

(c) Cadmium average based on platers' quotation.

(d) Domestic, 5 tons or more but less than carload lot, packed in cases, f.o.b. New York.

(e) Tin content.

(f) F.o.b. Port Colborne, U.S. duty included.

Markets Continued on Page 114

ing pressure has moderated at the lower prices and production is bound to decline, here as well as abroad. Slab zinc was available outside of this country as low as 10¢ a pound.

Tungsten ore in the free market has eased appreciably. The market was quotable at $41 to $42 per short ton unit of WO_3, c.i.f. U.S. ports, equivalent to about $50 duty paid U.S.

The British Government has terminated its purchasing program on tungsten ore because of an easing in the supply outlook in the free market. The British market was quotable at 310s. to 320s. per long ton unit.

"Free" Gold Market

The volume of business in free gold moderated last month. The carnival season in Latin American countries and the Chinese New Year contributed to a general slackening in demand. The Bombay market was higher, moving up to about the 1951 level. Other centers reported lower prices, compared with a month ago. Pick's World Currency Report quotes as follows:

	COINS		BARS (12.5 kg.)	
	Jan. 31	Feb. 28	Jan. 31	Feb. 28
NEW YORK, transit	.....	.....	$37.85	$37.35
MANILA	$47.50	$47.00	41.10	39.00
HONG KONG	47.00	46.00	40.90	40.30
BOMBAY	50.00	50.25	47.35	49.75
TANGIER	46.80	47.50	37.80	37.30
BEYROUTH	47.25	46.00	37.90	37.40
PARIS	50.60	50.25	38.95	38.40
BUENOS AIRES	47.00	47.00	40.50	39.50

Major Metals

U. S. DAILY AND AVERAGE PRICES

Feb. 1953	Electrolytic Copper (a) Domestic	(b) Export	Straits Tin New York	Lead New York	Lead St. Louis	Zinc East St. Louis
2	24.200	34.675	121.500	13.500	13.300	12.000
3	24.200	34.950	121.500	13.500	13.300	11.500
4	24.200	34.925	121.500	13.500	13.300	11.500
5	24.200	34.425	121.500	13.500	13.300	11.500
6	24.200	35.100	121.500	13.500	13.300	11.500
7	No Market	34.175	121.500	13.500	13.300	11.500
9	24.200	34.875	121.500	13.500	13.300	11.500
10	24.200	34.975	121.500	13.500	13.300	11.500
11	24.200	34.725	121.500	13.500	13.300	11.500
12	Holiday	35.000	Holiday	Holiday	Holiday	Holiday
13	24.200	34.875	121.500	13.500	13.300	11.500
14	No Market	34.575	121.500	13.500	13.300	11.500
16	24.200	35.350	121.500	13.500	13.300	11.500
17	24.200	34.575	121.500	13.500	13.300	11.500
18	24.200	35.125	121.500	13.500	13.300	11.500
19	24.200	35.400	121.500	13.500	13.300	11.500
20	24.200	35.175	121.500	13.500	13.300	11.500
21	No Market	34.625	121.500	13.500	13.300	11.500
23	Holiday	35.150	Holiday	Holiday	Holiday	Holiday
24	24.200	35.150	121.500	13.500	13.300	11.500
25	27.825	35.100	121.500	13.500	13.300	11.375
26	28.950	34.475	121.500	13.500	13.300	11.250
27	29.650	33.975	121.500	13.500	13.300	11.250
28	No Market	33.425	121.500	13.500	13.300	11.250
AVERAGES FOR MONTH						
Feb.	24.968	34.783	121.500	13.500	13.300	11.483
AVERAGES FOR WEEK						
Feb.						
4	24.200	34.792	121.500	13.750	13.550	11.833
11	24.200	34.713	121.500	13.500	13.300	11.500
18	24.200	34.917	121.500	13.500	13.300	11.500
25	25.106	35.100	121.500	13.500	13.300	11.475
CALENDAR WEEK AVERAGES						
Feb.						
7	24.200	34.708	121.500	13.500	13.300	11.583
14	24.200	34.838	121.500	13.500	13.300	11.500
21	24.200	35.042	121.500	13.500	13.300	11.500
28	27.656	34.546	121.500	13.500	13.300	11.325

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Feb. 1953	Sterling Exchange "Checks"	Silver (c) New York	Silver (c) London	Gold London	Gold (d) United States
2	281.8750	85.250	74.000d.	248s.	$35.00
3	281.8750	85.250	74.000d.	248s.	35.00
4	281.8750	85.250	74.000d.	248s.	35.00
5	281.9375	85.250	74.000d.	248s.	35.00
6	281.9375	85.250	74.000d.	248s.	35.00
7	(e)	(e)	(e)	(e)	35.00
9	281.9375	85.250	74.000d.	248s.	35.00
10	281.9375	85.250	74.000d.	248s.	35.00
11	281.9375	85.250	74.000d.	248s.	35.00
12	Holiday	Holiday	74.000d.	248s.	Holiday
13	281.8750	85.250	74.000d.	248s.	35.00
14	(e)	(e)	(e)	(e)	35.00
16	281.8750	85.250	74.000d.	248s.	35.00
17	281.8750	85.250	74.000d.	248s.	35.00
18	281.8750	85.250	74.000d.	248s.	35.00
19	281.9375	85.250	74.000d.	248s.	35.00
20	281.9375	85.250	74.000d.	248s.	35.00
21	(e)	(e)	(e)	(e)	35.00
23	Holiday	Holiday	74.000d.	248s.	Holiday
24	281.9375	85.250	74.000d.	248s.	35.00
25	281.9375	85.250	74.000d.	248s.	35.00
26	281.8750	85.250	74.000d.	248s.	35.00
27	281.8750	85.250	74.000d.	248s.	35.00
28	(e)	(e)	(e)	(e)	35.00
AVERAGES FOR MONTH					
Feb.	281.906	85.250	74.000d.	—	35.00
AVERAGES FOR WEEK					
Feb.					
4	281.825	85.250	—	—	—
11	281.938	85.250	—	—	—
18	281.875	85.250	—	—	—
25	281.938	85.250	—	—	—

Calendar Week Averages, New York Silver: Feb. 7th, 85.250; 14th, 85.250; 21st, 85.250; 28th, 85.250.

(e) No Market (Saturday).

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.300c. per pound, the average differential for delivery charges.

(b) Our export quotation for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.075c. for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingotbars; cathodes are sold at a discount of 0.125c. to 0.15c. per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered, in the East, Middle West, and West, effective Jan. 1, 1951, commanded a premium of 1.35c. per pound over the current market for Prime Western; Special High Grade 1.50c.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points.

(c) The daily New York silver quotation reported by Handy & Harman is for silver contained in ores and other unrefined silver-bearing materials, in cents and fractions of a cent per troy ounce. It is determined by Handy & Harman on the basis of actual sales of bar silver .999 fine in amounts of 50,000 ounces or more for nearby delivery at New York, as reported daily by regular suppliers, and is usually one-quarter cent below the price paid for such bar silver, this deduction being the allowance to such suppliers for carrying, delivering and marketing. In addition to foreign silver, the quotations also apply to domestic silver if such silver enters into the New York market.

The Treasury's purchase price of newly mined domestic silver is 90.5c. per troy ounce 1000 fine, effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold is at .99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

Behind the By-Lines . . .

G. P. Lutjen

Once a year, regular as clockwork, we devote a day of sheer envy to the employees of the Lincoln Electric Co., Cleveland, Ohio. Once a year we get a letter from Mr. James F. Lincoln, the president, telling about the company's annual incentive bonus based on productivity. This year 1,208 employees, everyone but James F, himself, split up $5,131,800. Cleverly applying a technique learned as a mere boy, long division, we find that the average slice per person is in the neighborhood of $4,248.18, a very nice neighborhood indeed. In fact, if Lincoln Electric can use a man with a long and brilliant record of racking billiard balls, it won't take us long to pack.

You can't be too careful in this business. Last month in the review of aluminum, we made the point that the aluminum companies were more than somewhat reluctant to talk about potlines and other phases of reduction plant technology. As we so innocently put it, "When you talk about the size of pots, the aluminum metallurgist becomes very vague. . . ."

In a brief note received this week, one metallurgist sets us straight. "I don't wonder," he says. "That's a personal matter, about which I am not only vague but very, very sensitive."

Always anxious to be of help, we are sending the gentleman a box of Ry-Krisp and a pair of oarlocks. If he can find a boat, oars and a lake, he'll have the physique of a Greek god in no time.

Your teacher may have neglected this so we are hastening to fill the gap in your geographic knowledge with this item from *Bylines and Dyelines.*

Not far from Madrid, Spain, stands the village of Cervera de Buitrago, "The Village of Many Fingers." It is so-called because every inhabitant, with one exception, has an unusual multiplicity of fingers and toes—usually seven on each extremity. Because the deformity is so widespread, these simple country people believe it is the visitor with five fingers to each hand who is abnormal. Through counting on their fingers, they have developed a system of counting by twelves instead of our universal decimal system.

Of course this seven-finger deal isn't really so unusual. During the war we once served under a 2nd Lieutenant with two heads.

Speaking of heads, maybe you've heard that hole-in-the-head expression that enjoys some vogue as a means of indicating you don't want to do something. For instance, when someone says, "You ought to take more exercise," you reply, "I need exercise like I need a hole in the head.'

Well, incredibly enough, it turns out there is a time when a hammer could use a hole in the head to advantage. In fact, it's one of this month's Operating Ideas, and a good one too. You'll read about it on page 118.

We spent most of last week in an unfruitful search for a Stirring Rallying Cry. We need one badly, so if you happen to have one, suitable for forces engaged in a clash with the Department of the Interior, we'd appreciate your forwarding it posthaste.

The stark fact is that Interior has Pearl-Harbored us with a news release entitled "Geological Survey Reports on Sources of Niobium." They don't seem to realize that we settled this columbium-niobium thing on this very page last August when investigation showed that the original discoverer named it "columbium" and "columbium" is used in textbooks. It was some bloke who "discovered" the stuff 43 years later that's responsible for this niobium folly. In view of the evidence, we thoughtfully advised Her Majesty's Department of Geological and Industrial Research in London, which has been pretty persistent in the use of the wrong term.

Now the USGS comes out with this release that talks about "niobium." Fortunately for our side, the seeds of their own undoing lie in the second paragraph which starts out, "Niobium, better known as columbium. . ." Thereafter, "columbium" is used throughout.

What is behind this nefarious determination to force niobium down our throats? Maybe this mad urge in geologists to make everyone else change steps is an occupational disease.

Metallurgists aren't infringing on the witchcraft business yet, but they're coming close. There is now a metal with a memory. Fellow by the name of Thomas A. Reed, a Columbia University metallurgy student, has discovered an alloy of gold and cadmium that is easily bent when cold but reverts to its original shape upon heating to 150 deg. F. The next step is to find a use for this metaphysical marvel. If you can think of one, you might drop a line to Mr. Reed.

To Anaconda Copper Mining Co. goes the credit for being the first company to introduce Sidewalk Superintendency to the mining industry. At Weed Heights overlooking the Yerington mine in Nevada, the company has provided viewpoint of the entire operation. You can relax right in your parked car or get out and lean against a sturdy rail, saloon style. Anaconda has been encouraging the public's use of the vantage point but draws the line at serving sandwiches and coffee. All in all it sounds like a good spot to take Uncle Fred. He's always saying, "I like work; I could sit and watch it all day." This remark being followed customarily by Uncle Fred's solo but unbridled hilarity.

We like this definition of *"mixed emotions."* The feeling you get watching your mother-in-law drive over a cliff in your shiny new convertible.

And if our mother-in-law reads this, we didn't mean it.

ENGINEERING AND MINING JOURNAL

MARCH, 1953

Equality for U. S. Metals

EVERY RIGHT-THINKING PERSON will agree that attainment of free and fair trade among nations is an essential part of that "just and lasting peace" that the United States has tried so hard to establish in the world.

Without free and fair trade among the several states, this nation itself would long ago have split up into a group of principalities, based on economic or geographical boundaries, and all at odds with one another.

It seems obvious, therefore, that the chances of recurring wars in the world would be at least, greatly lessened, if trade among all nations could be set to flowing freely and fairly.

Believing that, as we do, it may seem incongruous that we also endorse the stand taken recently by the emergency committee of zinc producers at the Colorado Mining Association meeting in Denver. With unusual unity, these producers, large and small, joined in calling for a sliding-scale import tax to be levied on imported lead and zinc whenever the domestic prices of these metals should fall below certain agreed-upon base prices. The amount of the tax, in cents per pound, would increase as the price declined, and would decrease as the price rose, disappearing altogether at and above the base level. Mr. Wormser, St. Joe vice president, suggests a base of 16¢ per lb. The committee suggested a base level of 15½¢ for lead and 14½¢ for zinc, or 30¢ for lead and zinc combined.

We approve the basic elements of this plan because we believe it comes nearer an equitable solution of a serious industry problem than any other suggestion we've heard.

In the first place, it is useless to talk about free trade among nations, as it exists among the United States, because the political and economic imbalances among nations are far too great. North Dakota and Arizona can trade wheat and copper freely and easily because politically, financially, economically, they are about equals.

There are very few pairs of countries in the world one could cite as similar examples. To strike all the world's tariffs off the books and then shout that trade had been freed, would be as foolish as to release the brakes on a car whose gas tank was dry and expect it to leap ahead up a hill. The world's currencies have to be strengthened, its standards of living built up; there has, in short, to be gas in the tank before the car can go.

U. S. lead and zinc miners have been victims of mistaken government policies in the United States, England, France, and elsewhere. When the U. S. piled its stockpile program on top of surging civilian and military demands, the other nations took fright and bought metals frantically, fearing our huge buying power would divert the world's metal to the U. S.

Big stockpiles, some built with U. S. funds, thereupon accumulated in Europe. It is reported, for example, that 200,000 tons of zinc remains in Europe to be disposed of. Not wishing to stockpile this metal, and finding they had bought vastly more than they could use, the European governments began to dispose of this metal, at about the time, unfortunately, when U. S. markets began to waver.

There is little slackening of consumption in the U. S. Lead and zinc markets have simply been depressed by pressure from abroad, and once again miners, here and abroad, are put through the wringer of a violent price swing.

This is trade, of a sort, but it is doubtful if it can be called free. The sliding-scale import tax is aimed only at requiring imports to come into this country on a basis fair to American producers. It is *not* aimed at blocking imports.

This country can use more metal than it can produce. Imports are essential, but it would be incredibly short-sighted, with the world in its present state, to buy those imports at the price of a crippled domestic industry.

As a matter of simple justice to American producers and to foreign producers as well, we'd like to see the sliding-scale import tax plan tried. We commend its authors, and we commend the willingness of the several segments of the domestic industry to yield some part of their special interests for the sake of getting together in unified support of this plan.

MINE NO. 1 of the Minerva Oil Co., which in the past nine years has built itself into the world's leading ceramic fluorspar producer. Minerva's modern mill produces both ceramic and metallurgical grade fluorite.

How Minerva Oil Co. Produces High-Grade Ceramic Fluorspar

OLIVER E. ANDERSON
Plant Manager, Minerva Oil Co.
Cave In Rock, Illinois

SINCE FLUORSPAR easily merits the title of the "modern nonmetallic mineral," (See comments page 78) the Minerva Oil Co.'s No. 1 mine at Cave In Rock, Ill., is of special interest—(1) because this property lies within the famous Illinois-Kentucky area which produces most of U. S. domestic fluorspar, (2) because the property is in Hardin County which alone accounts for 50% of our domestic production, and (3) because Minerva Oil Co. is the world's largest producer of ceramic grade fluorspar.

Officials of the Minerva Oil Co. who were alert enough to recognize the ascendency of fluorspar to the role of a major modern nonmetallic, and act upon this trend include Joseph Desloge, president, Gill Montgomery, general manager, and the late Mr. J. H. Steinmesch who served as vice president and general manager of the mining division of this company.

Through their efforts, and those of their staff, this company has established an enterprise which incorporates the latest in mining technology, and has solved the intricate problem of separating the valuable fluorspar from gangue to produce uniform high-grade metallurgical and ceramic grade fluorspar products.

This article is written to convey two divisions of practical information to the reader: (1) **Mining technology used.** Note for instance on pages 74 and 75 that three types of loading equipment are used—the front end loader, the tractor-mounted mucking machine, and the portable ramp and scraper loading unit. The rule at Minerva is "Get the muck loaded the best way possible."

(2) **Milling technology.** To produce consistent high-grade fluorspar products for market, the mill operators had to develop certain refinements. The description of the mill which follows and the flowsheet (See pages 76 and 77) indicates that much attention is paid to cleaning and up-grading concentrates. Thus multi-stage precleaning, cleaning and recleaning has been carried out to a high degree. Secondly the matter of control was contrived by having operators take hourly samples of pulp densities in key points, and checking on grade of froth produced by a quick lime determination.

The accompanying flowsheet and legend, plus tables applying to the concentrator will give the reader a complete report on the processes used in the crushing plant and mill. Hence the following comment is limited to details in the flowsheet of unusual interest, and an explanation of reasons for present metallurgical practices. All numbers in parentheses refer to equipment enumerated on flowsheet, page 77.

In the storage section, you will note that undersize from the SECO vibrating screen, fitted with 7/8-in. punch-plate openings, falls directly into a 250-ton bin which feeds the

grinding circuits, and that oversize is chuted to a 250-ton coarse ore bin which feeds crushing rolls. This method of ore storage has proved satisfactory because:

1. The fine ore bin has sufficient capacity to supply the plant during the night shift.
2. Feeding the grinding circuit is accomplished from one bin only.
3. The primary and secondary crushing plants are not tied together in case of repair to either equipment.
4. An increased ore supply on the surface is available with either unit operating separately or in closed circuit.
5. The blend of ore is more uniform physically and chemically.

Occasionally custom ore and middlings from other Minerva properties are hauled to the plant. This material is introduced by means of a 30-in. inclined conveyor with a 14-ft. rise in a length of 64 ft. It discharges onto the S-A apron feeder (2).

Grinding Circuit Revised

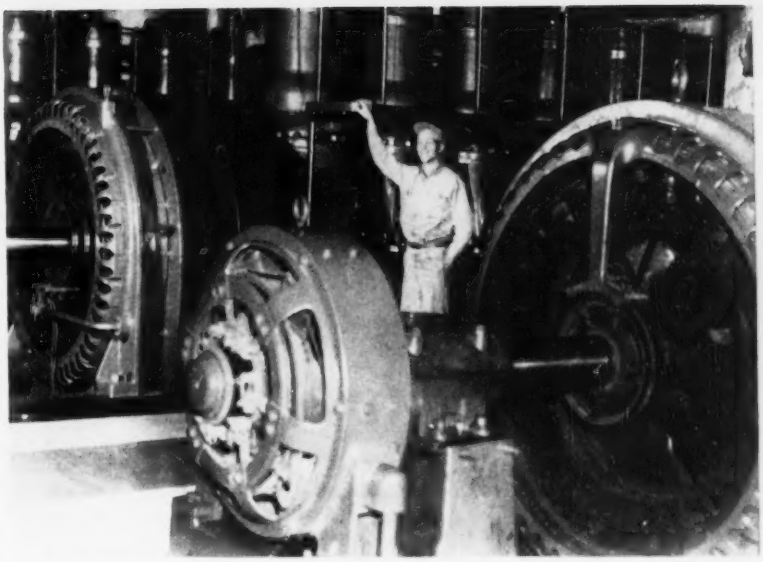
Today the grinding circuit consists of three-stage grinding and classification. However, at the outset of milling operations in 1944, grinding was single stage with 1½ and 2-in. balls. It was soon learned that grinding was the secret to good metallurgical results. The object was to obtain required liberation without excessive sliming which resulted in undue tailing losses.

The duty of grinding the coarse feed, consisting of fine-grained zinc and spar disseminated throughout a matrix of sandstone and hard dolomite, along with fragile, crystalline spar and zinc to a finished size of 100% minus 100-mesh and 85% minus 150-mesh, could not be accomplished at the same time without overgrinding the softer ores, and a build-up of the harder ores which in turn resulted in low tonnage to the grinding circuit.

Extensive study showed a marked advantage for installing the second grinding and classification circuit. Make-up grinding balls were increased to 2½ to 3-in. with lower pulp densities in the Hardinge mill (6). In the No. 2 mill only 1-in. grinding balls were used. This two-stage grinding resulted in such marked improvement, that studies were started on three-stage grinding. The third stage was added two years later.

The grinding circuit has not undergone any major change in the past two years. Discharge from the primary mill (6) has a density of 66% solids. Sand from the No. 1 Wemco classifier goes back to the primary mill, while overflow, with a density of 40% goes to an identical Wemco classifier (9) where the pulp is 31% solids. Sand from the second classifier is in closed circuit with a secondary 3x9-ft. ball mill (9), using 1-in. grinding balls. Discharge density is 55% solids. Overflow from the second classifier then goes to a rake-cone classifier (11) which is followed by third stage grinding in the No. 3 ball mill (16).

See accompanying tables showing feed to the No. 1 ball mill, and No. 3 classifier overflow, or flotation feed, page 76.



MINE AND PLANT ARE OPERATED on diesel-electric power generated in this 1260-hp. power plant containing three Fairbanks-Morse engines.

A Tribute to J. H. Steinmesch

Particular credit for the success of the Minerva Oil Co. project at Cave In Rock, goes to Mr. J. H. Steinmesch, Missouri School of Mines '09, who as vice president and general manager, visualized possibilities of the orebody after directing exploration leading to its discovery during the 1940-42 period. The plant, tailor-made for this particular ore, was mostly the result of his planning.

Until the day of his death on Dec. 15, 1952, at the age of 70, he remained in active charge of operations. Young engineers trained under him are deeply grateful for the leadership he imparted.

The Sphalerite Circuit

Pulp enters the zinc flotation circuit at 36% solids, and is conditioned with 0.09 lb. per ton sodium cyanide for activation of slimes, and 0.47 lb. per ton of copper sulphate. Details of the cleaner and rougher cell arrangement are shown in the flowsheet (17). Flotation reagents used in this circuit are copper sulphate, sodium cyanide, pine oil, B-23 alcohol, sodium Aerofloat, Reagent 211, and Reagent 633.

Fluorspar Circuit

Since the pulp density of zinc tailings drops to 25% solids, rethickening is necessary to keep hard water and chemicals used in the zinc circuit at a minimum. This is done in a 36x10-ft. thickener (21). Underflow goes to a 6x6-ft. conditioner (23) fitted with a 5-ft. submerged steam coil to keep feed pulp temperature at 90 deg.

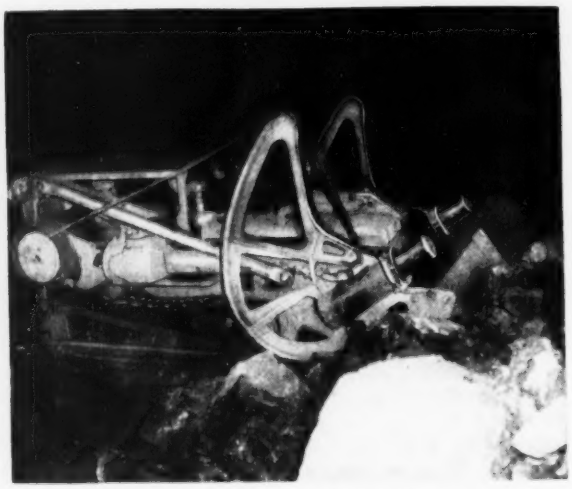
Eight No. 21 Denver cells, with the ninth acting as a rougher scavenger, are used in the fluorspar roughing circuit (24). Froth from the first six roughers constitutes feed to two No. 30 Denver cells, designated as pre-cleaners because their work is pre-cleaning an exceptionally low-grade product from the roughers, where recovery is a prime factor. The last two roughers are pulled for a low-grade froth, it being the last chance to recover the fluorite. Therefore this froth is bypassed to a single scavenger rougher-cleaner cell which effects some upgrading before the froth is passed

In the Mine—Equipment Is Selected To Fit the Job.

DRILLERS FAVOR this type of jumbo consisting of a 5-ton truck chassis powered by a 5-hp. electric motor.

O. E. ANDERSON (left) and F. Callahan, mine superintendent watch F. Frailey operate Hough Payloader.

CRAWLER-MOUNTED SLUSHER with 20-hp. hoist loads ore directly into diesel trucks at the heading.



DEVELOPMENT HEADINGS ARE MUCKED with this diesel-powered crawler-mounted Eimco Model 102 loader.

MINE-RUN ORE is conveyed over a 30-in. belt from the face, 1200 ft. to a transfer raise.

ORVAL PATTON, operator, guides a 2½-ton Mancha storage battery locomotive pulling 6 cars to the shaft.

Mining In Brief

GEOLOGY AND ORE DEPOSITS. Geological formations exposed in the Cave In Rock district are sedimentary—sandstones, limestones, and shales of the Mississippian System. Lowest formation is the St. Louis limestone. The Minerva ore deposit is a bedded replacement type of hydro-thermal origin in Mississippian limestones trending N. 55 deg. E., generally paralleling the Peters Creek fault zone. The deposit follows groups of joint-like fractures and minor pre-mineral faults which are considered to be channelways for mineralizing solutions. The ore deposits consist of flat-bedded, lenticular replacements of Upper Renault limestones immediately below the Bethel sandstone, which constitutes the roof of the mine workings. Orebodies are lens-shaped, 30 to 300 ft. wide, and more or less wedge-shaped. Thickness ranges from 3 to 20 ft. with a mine average of 9 ft. Orebody length sometimes exceeds a mile. Trend of the orebodies is mainly N. 55 deg. E., with general dip of 3½ deg. to the northeast, in beds dipping 7 deg. northward.

THE ORE. Minerva ore is of medium hardness, vuggy and fitchery in spots, but generally easily broken. (See Mill Feed for analysis.)

MINING METHOD. The Bethel sandstone roof is locally not too strong because of cross-bedding. This calls for 10 to 18-ft. dia. pillars on 40 to 60-ft. centers for roof support. With open-stope and pillar methods, initial extraction is about 65%. Eventually on retreating, extraction will be increased to plus 90%. Mining is now advancing on the East and West orebodies, about 600 ft. apart and approximately parallel.

DRILLING. Both 3½ and 4-in. automatic drifters are mounted on several types of jumbos. Best-liked jumbo consists of foreshortened 5-ton truck chassis, powered by 5-hp. 550-v. motors V-belt connected to two truck transmissions which act as speed reducers. Eleven-ft. wagon sashes are raised by air tuggers by cables over a pulley post. Crawler-tractor, air-powered jumbos are being supplanted by faster, more maneuverable, rubber-tired machines. All have been constructed in company shops. Drill rod is 1¼-in. in lengths up to 13 ft. Two-man drill crews each with a jumbo, use slab rounds to break the required 325 tons per shift, operating day shift only.

LOADING EQUIPMENT. Three types used: (1) Two crawler-mounted slushers, powered by 7½-hp. motors for travel, with 20-hp. three-drum electric hoist pulling 48-in. scrapers. (2) A 1½-yd. Hough Payloader. (3) An Eimco 12-B air-operated track-mounted shovel for driving drifts.

HAULAGE AND CONVEYING. Ore from face is loaded into 2-ton Chevrolet dump trucks powered by DOOD Hercules 79-hp. diesel engines complete with exhaust scrubbers. Trucks haul ore to a 30-in. conveyor which transports ore 1,200 ft. to a transfer chute. The 30-in. Barber-Greene conveyor, installed parallel to and bisecting the orebody, has a loaded down-hill grade of about 6 ft. per 100 ft. It can be loaded at right angles by use of a 48-in. belt feeder and truck hopper.

Construction is nearly complete on a 500-ft. truck and belt drift clear to the hoisting shaft. Ore will then be discharged from a belt directly into a 250-ton storage raise near the shaft bottom where the ore will be loaded into the ore skips. Completion of this construction will nearly eliminate track haulage.

HOISTING. Two-ton skips are hoisted in balance from the 630-ft. haulage level by a 150-hp. double-drum Lambert hoist fitted with 6-ft. cylindrical drums. Hoisting rope is made of 1-in. improved plow steel. Hoisting speed is 700 fpm. Skips discharge into a 120-ton steel ore bin. The ore bin and waste bin are so arranged that a powered winch-operated gate between them will transfer rock to either bin.

SHAFT SINKING. A three-compartment shaft serving the mine has been sunk between the two main orebodies. In sinking the 645-ft. shaft, the company borrowed oil-field practice, and drilled a 6-in. hole to shaft depth through which a water-bearing sandstone horizon was grouted with Dowell cementation equipment. Eleven hundred sacks of cement were pumped into the 300-ft. of sandstone beds at pressures of 1,500 lb. As a result, very little water seeped into the shaft during sinking. In addition, about 40% of the shaft was lined with concrete to retain Mississippian shales encountered.

PUMPING. Water originating in many small channels in the orebody is deflected by gravity into settling sumps from which it is pumped through a 10-in. drill hole by two Oil Well No. 8P., 5x8-in. high-pressure duplex piston pumps, rated at 180 gpm against a 700-ft. head. Water goes to mill supply ponds. The mine now makes 150 gal. of water per min.

COMPRESSORS. Two 600-cfm I.R. compressors supply the mine with 80-lb. air.

POWER PLANT. All plant power is supplied by a diesel plant which carries a load of 10,000 to 13,000 kwh. every 24 hr. Cost of power is 1½¢ per kwh. Two engines are Fairbanks-Morse, 450-hp. 300-kva units, generating 2300 v.; and the third is a 360 fm 360-hp., 240-kva engine. Cooling water is held to 125 deg. F. Lubricating oil is clarified by a Honan Crane filter. A 190-gpm Permutit Zeolite water softener supplies soft water to the engine cooling system and the fluorspar flotation circuits of the mill.

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on to the tail end of the cleaners.

Froth from the precleaners flows to the seventh cell of a battery of 12 cleaners (26 and 27) where it begins the slow process of upgrading with each successive cleaning. Froth and middlings on the tail end of the cleaners contain a greater amount of intimately locked particles, and must be recleaned in a series of cells (52), at which point either a metallurgical or special ceramic grade fluorite is constantly bled from the circuit.

Middlings from the precleaner, cleaner, and recleaner circuits are combined through a 10x10-ft. thickener (48) where the underflow goes to the regrind mill (50). Discharge from the mill is combined with the thickener overflow and goes back to the spar roughing circuit.

Principal reagents used in the fluorspar circuit consist of sodium cyanide, sodium carbonate, sodium silicate, General Mills Aliphat 44B, Quebracho extract, Emersol 300, and B-23 alcohol. Reagents are fed with Clarkson stainless steel feeders. Reagents are stage fed for closer control, with 10% solutions used generally.

"Guess work" of concentrate grades in the fluorspar circuit has been eliminated with the introduction of a quick lime determination. These quick tests are made hourly for grade and circuit control. Only zeolite-softened water is used in the fluorspar circuit, and densities are taken hourly at all key control points.

The Minerva Oil Co. has built itself up into the world's leading ceramic fluorspar producer in the last nine years. Three uniform but different grades are shipped regularly. See accompanying table of analyses, page 76.

Based on fluorite content, the ratio of No. 1 ceramic grade concentrates produced to the No. 2 ceramic or metallurgical grade, averages 3.3 to 1.

Spar tailings averaging 3.4% CaF_2 resulting in a 92% plus recovery, and with a pulp density of 15%

Facts About the Mill

MILL FEED. The ore fed to the primary crusher ranges in size from large boulders to sticky mud. It consists of a disseminated mixture of calcium fluoride, quartz, sphalerite, calcite, dolomite, barite, shale, witherite, and organic materials. Average chemical analysis of the mill feed is:

CaF_2	29.60	Zn	3.80	$BaSO_4$	1.60
$CaCO_3$	35.75	R_2O_3	2.90	Pb	nil.
SiO_2	21.50	MgO	2.00		

PRODUCTION RATING

Mine, underground	Six 8-hr. days per week.
Tons of ore per mine-man-shift	10.5
Primary crusher (Gruendler)	40 tons per hr.
No. 1 conveyor	150 tons per hr.
Screening	150 tons per hr.
Crushing rolls	85 tons per hr.
Feed rate to grinding circuit	10.5-11 tons per hr.
Milling, filtration, drying	Seven 24-hr. shifts/week.
Tons per mill-man-shift	15-16.5
Tons milled per man on plant	3.5-4.0

ZINC CONCENTRATE ANALYSIS:

Zn	63.5%	Germanium	0.025%
CaF_2	0.65%	Pb	0.18%
Cadmium	0.95%	Fe	0.36%

ZINC TAILINGS

Range from 0.08 to 0.25% Zn, with an average of 0.17%. Zinc recovery is constantly above 96%.

SCREEN ANALYSES

Feed to No. 1 Ball Mill (6)		No. 3 Classifier Overflow (11)		
Size	Percent	Size	Wt. %	Cum. %
+1 in.	1.54	+ 65	0	0
−1 +½ mesh	11.98	− 65 +100	3.03	3.03
−½ +¼ mesh	20.79	−100 +150	10.61	13.64
−¼ mesh	65.69	−150 +200	10.61	24.25
		−200 +325	23.48	47.73
		−325	52.27	100.00

CONCENTRATES GRADES AND SCREEN ANALYSES

	No. 1 Ceramic Fluorite	No. 1 Special Fluorite	No. 2 Ceramic Fluorite
CaF_2	95.83	93.65	87.47
SiO_2	1.69	2.81	5.20
$CaCO_3$	1.76	2.41	6.07
$BaSO_4$	0.32	0.68	0.32
R_2O_3	0.14	0.30	0.73
Fe_2O_3	0.11	0.15	0.21
+100 mesh	0.44	0.50	0.54
−100 +150	0.44	1.25	0.27
−150 +200	17.28	16.50	16.97
−200 +325	22.10	21.75	18.05
−325	59.74	60.00	64.17

solids, are pumped 14,000 ft. through a 4-in. line over a 125-ft. range of hills and into a large ravine. Two Oil Well 5x8-in. piston mud pumps handle this load.

Filtration and Drying

The three fluorspar froth concentrates produced are sampled hourly to determine grade. The concentrate is then diverted to one of five wet reservoir thickeners depending on grade. Overflow from these thickeners flows from highest to lowest grade so that no contamination of the concentrates is possible. Filtrates are also returned to their respective tanks.

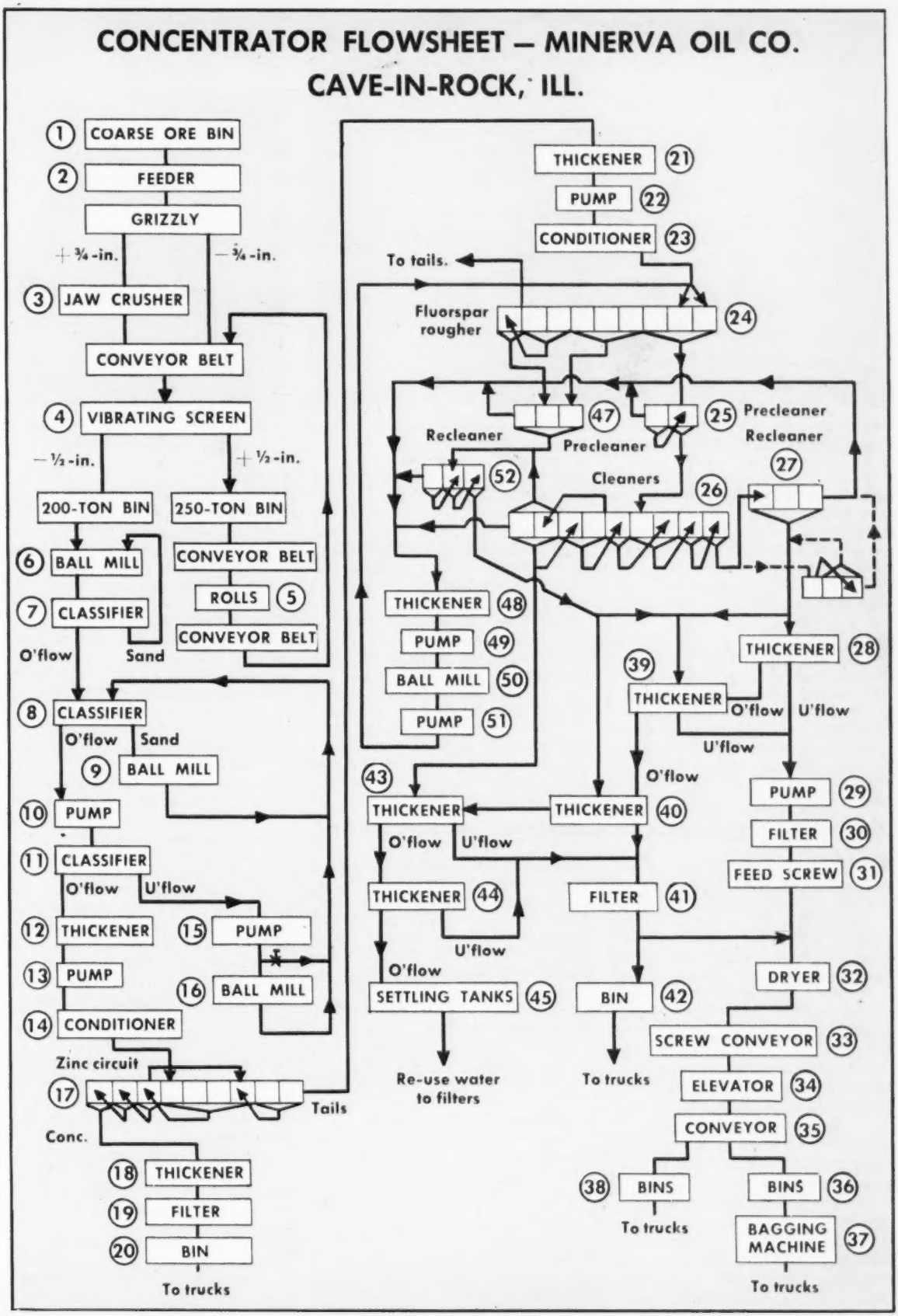
No. 1 Ceramic grade goes to an Eimco drum filter (30) covered by a 60x60-mesh, twill-weave, stainless steel cloth which is backed by a 4-mesh stainless-steel screen. The Special ceramic and No. 2 ceramic grades of concentrates are pumped to a 3x6-ft. Dorrco filter (41) which uses nylon filter cloth. The filter cake from both filters goes to a rotary dryer (32) which is fitted

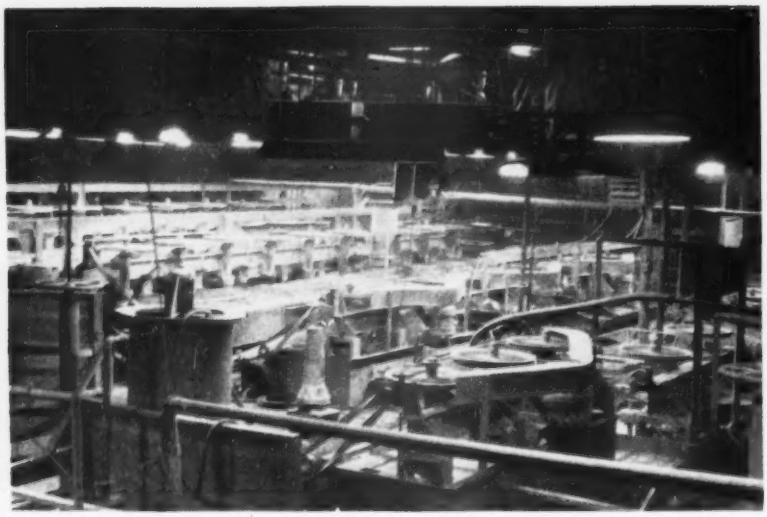
LEGEND

1. Coarse ore bin, 75-ton.
2. Apron feeder, Stephens-Adamson, 36-in x 8 ft. 2 in.
3. Jaw crusher, Gruendler, 15x36-in.
4. Vibrating screen, Seco, 4x12-ft. 7/8-in. opening.
5. Crushing rolls, Denver, 36x14-in.
6. Ball mill, Hardinge, 7x4-ft.
7. Classifier, Wemco, double-pitch screw, 60-in. x 23 ft. 3 in.
8. Classifier, Wemco, double-pitch screw, 60-in. x 25 ft. 9 in.
9. Ball mill, Allis Chalmers, 3x9-ft.
10. Sand pump, Wilfley, 4-in.
11. Rake-cone classifier, 8 ft. 3 in.
12. Thickener, 36x10-ft.
13. Diaphragm pump, Denver, 6-in.
14. Conditioner, Wemco, 6x6-ft.
15. Diaphragm pump, Denver, 4-in.
16. Ball mill, Allis Chalmers, 3x9-ft.
17. Flotation machine, Denver No. 21, 9 cells. (Zinc circuit)
18. Thickener, 18x10-ft.
19. Filter, American double-leaf, 6-ft.
20. Zinc concentrate storage bin, 40-ton.
21. Thickener, 36x10-ft.
22. Diaphragm pump, Denver, 6-in.
23. Conditioner, Wemco, 6x6-ft. (Steam heated to 90 deg. F.)
24. Flotation machine, Denver No. 21, 9 cells. (Fluorspar roughers)
25. Flotation machine, Denver No. 30, 2 cells. (Fluorspar precleaners)
26. Flotation machine, Denver No. 21, 9 cells. (Fluorspar cleaners)
27. Flotation machine, Denver No. 21, 3 cells. (Fluorspar precleaners)
28. Thickener, 18x10-ft. (No. 1 Premium Grade fluorspar)
29. Diaphragm pump, Denver, 4-in.
30. Drum filter, Eimco, 4x5-ft.
31. Feed screw to dryer.
32. Cylindrical dryer, Ruggles-Cole, 48-in. x 26-ft., oil fired.
33. Screw conveyor.
34. Bucket elevator, Stephens-Adamson.
35. Reddler conveyor, Stephens-Adamson.
36. Two dry-storage bins, 35-ton.
37. Bagging machine, St. Regis Twin.
38. Two storage bins, 125-ton.
39. Thickener, 18x10 ft. (No. 1 ceramic grade fluorspar.)
40. Thickener, 20x20-ft. (Glassmakers' ceramic grade fluorspar.)
41. Filter, Dorrco, 3x6-ft.
42. Storage bin, 1,800-ton.
43. Thickener, 16x18-ft.
44. Thickener, 16x18-ft.
45. Three settling tanks, 20x40-ft.
47. Flotation machine, Denver No. 21, 3 cells. (Fluorspar precleaner.)
48. Thickener, 10x10-ft. (Fluorspar mids.)
49. Diaphragm pump, Denver, 4-in.
50. Ball mill, Allis Chalmers, 3x5-ft.
51. Sand pump, Wemco, 3-in.
52. Flotation machine, Denver No. 21, 3 cells. (Recleaner.)

Note: Three Denver cells above 28 on flowsheet are stand-by Recleaners.

In the Mill—Products Are Precleaned, Cleaned, Recleaned.





HIGH GRADE OF FLUORSPAR products is maintained with 32 Denver cells comprising the fluorspar flotation section of the Minerva concentrator.

LLOYD BARNARD, flotation operator checks key pulp densities.

with an 8-ft. cyclone followed by a No. 14 Air Filter Roto-Clone dust collector. A temperature of 400 deg. is maintained. This reduces moisture content to 0.10%.

The metallurgical grade is filtered and conveyed to a 2,500-ton open concrete storage bin without being dried. An I-R three-drum electric tugger and 48-in. scraper are used over an incline ramp for trimming and loading trucks.

A modern chemical laboratory handles a wide variety of analyses under direction of Durward C. Spees, chemist. Ulys Douglas, chief mechanic, is in charge of the machine shop, and George Jenkins, chief electrician is in charge of the electrical shop which serves both mine and mill. The diesel power plant operates under the direction of Cyrus McConnell, powerhouse engineer.

This article appears with the permission of Joseph Desloge, president of Minerva Oil Co., who in the late 1930's visualized the growth and demand for fluorspar in the fluorine industry. Special mention is also due Gill Montgomery, general manager, who from the start has provided the directive spirit of the organization.

Fluorspar—The Modern Industrial Non-Metallic Mineral

FLUORSPAR can readily be classified as a key mineral indicating the degree of industrialization of a country. The more fluorspar the country consumes, the more advanced is its industrialization. This is true principally because fluorspar is geared to the steel industry and to the growing aluminum industry. Mainly because of the expansion of the steel industry in the U. S., consumption of fluorspar will rise from 388,885 tons in 1943, to an estimated 575,000 tons in 1953, one decade later. Second largest consumer of fluorspar, and contributing substantially to this great increase in consumption, is the chemical industry. A whole new family of fluorine chemicals is being evolved by forward looking companies who recognize that fluorine occupies the unique position of being one of the most corrosive of chemical constituents, and at the same time being one of the most stable. Thus in the atomic energy field, uranium hexafluoride (very corrosive) is employed to effect separation of U-238 from U-235, and yet fluorine compounds are also employed to make gaskets which are exceedingly stable and will resist the corrosion of the hexafluoride gas.

Refrigeration is likewise a modern convenience, and here fluorine compounds play an important part as Freon gas, which is used extensively in refrigeration plants.

The ceramic industry is the third largest user of fluorspar. A high quality product is required, and must be relatively free from iron or other coloring material. It is used in the manufacture of glass where opaque, colored, or clear glass is desired. Manufacturers of enamel and vitralite use it as a fluxing and opacifying agent.

Miscellaneous uses of fluorspar, in addition to those in the atomic energy and refrigerant field, include brilliantly colored dyes, "bug bombs," alkylation for 100-octane aviation gasoline, and in the manufacture of aluminum and magnesium. Some fluorspar is used in the clinkering process for the manufacture of cement, and in rock wool and glass fiber industry to reduce viscosity. It is used as a paint pigment, as a binder in abrasives, as a mineralizer in certain ceramic industries, in the manufacture of carbon electrodes, as a catalyst, welding fluxes and rods. Since a small amount of fluorine prevents dental caries, some dentifrices contain fluorine compounds. It is also reported that one to three parts per million of fluorine in drinking water is sufficient to prevent dental caries. Insecticides, germacides, rodenticides, plastics, drugs along with hundreds of other uses are being discovered by experienced staffs of the chemical industry. Surely fluorspar is looking forward to a bright future.

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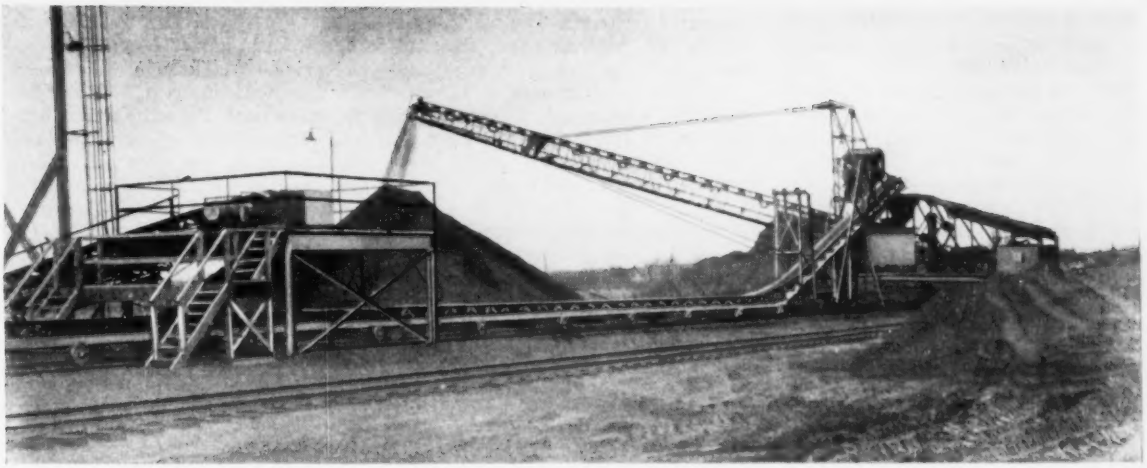


CONCENTRATES can be stockpiled at rate of 600 tph with this revolving Link-Belt stacker and trailing conveyor in two parallel piles, each 42 ft. high, 125 ft. wide, and 550 ft. long. Radius of stacker boom is 115 ft.

Concentrate Stocking a Help in Shipping Lake Iron Ores

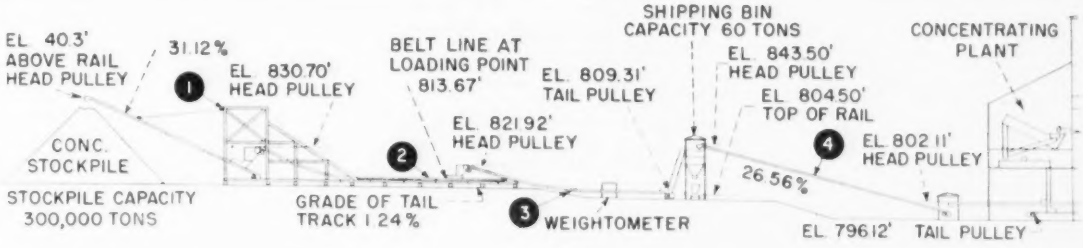


DIAGRAM of traveling stacker and trailing conveyor, showing relationship of components.

1. Concentrate Stockpile Stacker
Capacity—600 tph.
Radius of swing—115 ft.
Motor—40 hp.
Swing—240 deg.

2. Conveyor
Make of belt—U.S. Rubber "Giant"
Width 30 in., Total length, 1,249 ft.
Length (c. to c.) 609.67 ft.
Belt speed—400 fpm.
Diameter head pulley—24 in., Drive pulley, 30 in.
Maximum capacity—600 tph.
Motor—60 hp.
Vertical lift—18 ft.
Construction—5 ply, 32 oz., 3/16 in. W/Br x 1/16 in.

3. Conveyor
Make of belt — Manhattan "Master"
Width 30 in., Total length 301 ft.
Length (c. to c.) 145.70 ft.
Vertical lift—12.61 ft.
Belt speed—400 fpm.
Diameter head pulley—36 in.
Grade—variable
Maximum capacity (continuous) 450 tph.
Motor—25 hp.
Construction—5 ply, 28 oz., 3/16 in. W/Br x 1/16 in.

4. Conveyor No. 4
Make of belt—U.S. Rubber "Giant"
Width 30 in., Total length 390 ft.
Construction—5 ply, 32 oz., 3/16 in. W/Br x 1/16 in.
Length (c. to c.) 187.06 ft.
Vertical lift—47.38 ft.
Belt speed—400 fpm.
Diameter head pulley—36 in.
Grade—26.56% (14 deg. 52 min. 32 sec.)
Maximum capacity (continuous) 450 tph.
Motor—75 hp.

JOHN J. FOUCAULT
Superintendent
Holman-Cliffs Mine
Cleveland-Cliffs Iron Co.
Nashwauk, Minn.

AT THE PRESENT TIME, approximately 30% of the iron ore produced from the Mesabi Range is concentrated. Methods used vary with the type of ore, but all flowsheets use considerable amounts of water. Due to freezing temperatures, the season during which ore can be processed extends usually from the last week in April to the latter part of October.

Navigation on Lake Superior, by which the ore is transported to lower lake ports, is usually open

from early April to mid-December.

These conditions cause a time lag of approximately two to three weeks in the spring and three to four weeks in the fall when no concentrates are being produced but shipping is available.

To overcome this condition, companies that have no direct-shipping ore must stockpile sufficient concentrates during the plant-operating season to have ore available and take advantage of the full shipping season on the lakes.

Also, during the plant-operating season considerable delay is likely to be experienced due to storms, fogs, etc., on the lakes, disrupting boat schedules and causing shortage of railroad cars for loading at the plants.

Uninterrupted Operation

With a stockpiling scheme, like the one described here, there is no stoppage in the production of the plant during its operating season, and sufficient ore is placed in stock for loading during the times when the plant cannot be operated but shipping on the lakes is available. It has further decided value in that the ore can be partially bedded in the stockpile. This feature is of great advantage to mines operating in marginal areas where extreme ranges in iron content and structure in the crude ores cause wide variations in the grade of concentrates produced.

As an example, at the Holman-Cliffs mine of the Mesaba-Cliffs Mining Co. (subsidiary of Cleveland-Cliffs Iron Co.), during the 1952 season, operation of which was disrupted by a two-month strike, the plant product was stockpiled 35% of the time and approximately 300,000 tons was placed in stock. Of this, half was loaded after the concentrating season was over and the remaining half is available for loading next spring, as soon as the lakes are open.

As can be seen from the flowsheet and picture, the concentrates are transported by belt conveyor to a bin for loading railroad cars, or if no cars are available, the product can be discharged onto the stocking equipment by opening a gate. There is no loss of time as the change takes place almost instantaneously. The ore is carried on a fixed conveyor, over a Weightometer, to be discharged on the "trailing section" of the stacker.

This trailing section has approximately 500 ft. of loading length plus an inclined section for loading the swinging boom. The whole unit travels on a wide-gage railroad track at 15 fpm and can negotiate a 2% maximum grade. It is self-propelled. The swinging boom, with a radius of 115 ft. and designed to swing 210 deg., can make two storage piles 42 ft. high, 125 ft. wide, and 550 ft. long on each side of the stacker. Due to the ease of propelling, it is simple to stock several grades separately with this arrangement. All drives use 220/440-v., 3-phase, 60-cycle power. The system is interlocked.

Loading from the stockpile is done by a standard 5- or 6-cu. yd. electric shovel. Three loading tracks are provided. One is in between the two piles, and the others are outside of them respectively. Cars are dropped from the empty-car storage yard to the loading point and thence to the load yard by gravity. By this arrangement it is possible to load approximately 950 tph. at a low cost.

Three such installations are now in use at properties operated by Cleveland-Cliffs.

Minnesota's Iron Sulphide Ores Have Promise

MINNESOTA'S IRON SULPHIDE DEPOSITS in Aitkin and Carlton Counties some day may provide the state with a new industry, sulphur, and also may prove the missing link in the development of Cuyuna Range manganese, Paul T. Allsman, Region V director of the U. S. Bureau of Mines, said recently. Bureau laboratory tests with flotation on ores from two deposits averaged 87% recovery of sulphur. Recovery of iron averaged 76%. The concentrate is relatively low in silica.

The Bureau is making pilot-plant tests with SO_2 gas in the recovery of manganese from Cuyuna carbonate slates in a sulphatizing furnace. This will be followed by leaching in a flotation plant that is to be installed in the Bureau's manganese pilot plant at Fort Snelling. If the use of SO_2 gas is as successful as the tests have indicated, iron sulphide could be burned to produce it for recovering manganese. With North Dakota lignite as a potential source of fuel and power for a commercial plant, three great natural resources of the two states could be made the basis for a new industry, Mr. Allsman said. The Cuyuna Range has about 500-million tons of low-grade iron material containing 10- to 25-million tons of manganese.

During the latter half of 1950, the Bureau drilled 12 diamond-drill holes totaling 2,347 ft. in Aitkin County. Three holes totaling 561 ft. were later drilled in Carlton County. A mining company subsequently took an option on the property in Aitkin County, and did considerable drilling.

The Background

The sulphide deposits in Aitkin County comprise two orebodies, and those of Carlton County, one. The sulphides are predominately pyrite and pyrrhotite, with minor amounts of marcasite. Also associated with the sulphides are quartz, mixed carbonates, biotite, sericite, iron silicate, and carbonaceous gangue minerals. The deposits are near the Northern Pacific Railway, the closest supply center being Aitkin. State tax laws favor the development of these deposits. The sulphides are classified in the same category as taconite, resulting in a low property tax.

Strongly magnetic belts have been known for years in Glen Township, Aitkin County, 15 mi. southeast of Aitkin. Initial drilling was done in 1922-23 by Berrigh Magoffin, Jr., of Deerwood, who drilled about 80 holes for iron ore. Records are meager.

Slates Contain Sulphides

In 1940, J. C. O'Connell became interested in the sulphides as a source of sulphur and a high-grade iron product. In 1941, Butler Brothers took an option on his rights. Under A. E. Matson's supervision they made two surveys. This was followed by drilling, which disclosed a shallow orebody consisting of pyrite and pyrrhotite in a dense, graphitic black slate. Five of the 13 holes drilled were on lands of which the state owned the mineral rights. Butler Brothers released their option in 1943.

In 1945, Mr. O'Connell organized the Glen Development Co. To delineate the deposit further and to determine the reserves present on state-owned lands, the Minnesota Iron Range and Resources and Rehabilitation Commission drilled 19 holes more in 1946. A substantial tonnage of sulphides has been proved.

E&MJ REPORT

New Oxide Lead Unit for Darwin

Premier lead and zinc producer of California is milling 120 tons of oxidized lead-silver ore besides its regular output of 300 tons of lead-zinc sulphides daily.

J. B. HUTTL
Associate Editor

THE PRESENT PHASE of Darwin Mines' operations, featuring the mining and milling of pyritic lead-zinc and oxidized lead-silver ores, began in Aug., 1945 when Anaconda Copper Mining Co. took the property over. Darwin Mines had been controlled by Arthur J. Theis and associates. Soon afterwards Anaconda proceeded to expand the underground mining and the surface plant and milling facilities for an output of 450 tons of ore daily.

Intermittent Work

Darwin is a relatively old camp, with mining of rich oxidized lead-silver ore dating back to the early 70's. It is about 30 mi. east of Olancha, in Inyo County, Calif., the nearest shipping and supply center being Lone Pine. At one time, several mills and smelters were active and the town had a population of 5,000. After 1880 gradual exhaustion of the rich surface ores, the isolation of the district, and unfavorable metal prices allowed only intermittent operations under different ownership until World War II. Total production made in the district up to 1945 is estimated at some $7-million.

Present holdings are a consolidation of a number of properties. These are: the Bernon, Columbia, Defiance, Driver, Essex, Independence, Lane, Liberty Group, Lucky Jim, Promontory, Rip Van Winkle, Southwest and Thompson mines, covering 44 patented and 45 unpatented claims and several mill sites. At the time of my visit early in October, daily production amounted to 300 tons of lead-zinc sulphide ore, some 120 tons of oxidized lead-silver ore, and 10 to 20 tons of direct shipping ore.

Geology and mineralogy of the deposits are most interesting. According to Davis and Peterson,[1] the orebodies occur as replacements of silicated limestone (tactite) rocks, bedded replacements, or fissure fillings. All lie in a thick series of Paleozoic (probably Pennsylvanian) limestone, dolomite, shale and quartzite which have been folded and faulted. The most prominent structure is a northwest pitching anticlinal fold, the crest of which lies just west of the ridge line of the Darwin hills. The east branch, or limb, of this fold has been intruded by the Darwin granodiorite stock and its associated dikes and sills, grading from granite to gabbro. Peripheral to the stock is a silicated (tactite) zone up to 2,500 ft. wide. All metallization is related to this stock. On the south and west the sedimentary series has been intruded by the Coso granite batholith. Of the three principal systems of faulting and fissuring found in the district, nearly all post-intrusive and pre-mineral in age, the Darwin tear fault striking N 60 to 75 deg.

Minerals Many

Darwin's deposits contain many rare minerals and mineral associations. Minerals encountered in the unoxidized ore zones are argentiferous galena and sphalerite with lesser amounts of chalcopyrite and tetrahedrite in a pyrite, fluorite, and calcite gangue. The high-grade ores were produced by extensive near-surface leaching of zinc, sulphur, and iron; minerals contained include cerussite, anglesite, plumbojarosite, and galena. Accessory minerals in the oxidized zone are iron oxides, jasper, clays, sulphur, gypsum, jarosite, calcite, hydromica, quartz, and fluorite. One end of a high-grade oxidized lead-silver stope worked some years ago was found to assay 10 to 15% WO_3.

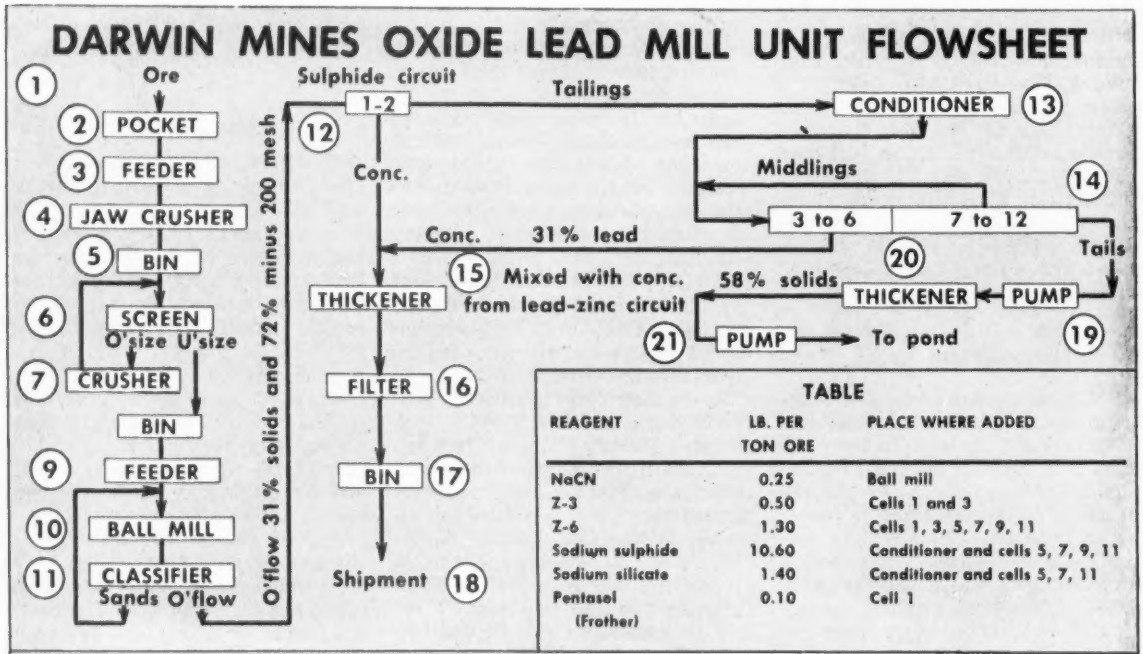
Entry by Tunnel

The Radiore tunnel, also known as the 400 level, is the principal entry and haulageway for the mines. It was started in 1926 and connects the workings of the Defiance and Bernon mines and the Independence-Thompson group. The tunnel was driven 1,430 ft. N 20 deg. E, then 2,740 ft. N 15 deg.-20 deg. W, and then more than 1,200 ft. north. Of the total length of more than a mile, some 2,600 ft. was driven by Anaconda. Workings of the Defiance mine, formerly developed by an adit and 500-ft. incline shaft, are connected to the Radiore tunnel by a series of raises and an inclined winze extending to the 570 level. The Independence and Thompson group are accessible from the Radiore tunnel by means of a raise and winze, known as the main working shaft, terminating at the 600 level. Both mines were formerly worked through adits. Two other tunnels are the Essex and the Intermediate.

Mining methods employed in the various sections of the property are not standardized but fit conditions found in each ore zone. In the oxidized zone, particularly in the loose, heavy, high-grade areas, squareset stoping is employed. The slot method used in these stopes and in which waste fill is seldom used is a modified version of the practice developed at Butte. In large replacement orebodies, pillars are left between the squareset stopes, subsequently to be recovered by a modified Mitchell top slice.

[1] Dudley L. Davis and E. C. Peterson. "Anaconda's Operation at Darwin Mines, Inyo County, Calif." AIME, TP 2407.

NEW OXIDE LEAD MILLING UNIT, 125 tons daily capacity, is housed in this 350-ton lead-zinc sulphide flotation plant.



TABLE

REAGENT	LB. PER TON ORE	PLACE WHERE ADDED
NaCN	0.25	Ball mill
Z-3	0.50	Cells 1 and 3
Z-6	1.30	Cells 1, 3, 5, 7, 9, 11
Sodium sulphide	10.60	Conditioner and cells 5, 7, 9, 11
Sodium silicate	1.40	Conditioner and cells 5, 7, 11
Pentasol (Frother)	0.10	Cell 1

LEGEND

1. About 120 tons of oxidized ore averaging 7% lead
2. Oxide ore pocket at mill ore storage plant
3. Shaker feeder
4. A-W jaw crusher, 15x20-in. (set to minus 2-in.)
5. Intermediate bin
6. Symons vibrating screen, 3x6-ft. (minus ½ in.)
7. Symons cone crusher, 3-ft.
8. Fine-ore bin, 300-ton
9. Conveyor feeder, 24 in. by 30-ft.
10. Union Iron Works ball mill, 6x6-ft.
11. Wemco SH simplex classifier, 36-in.
12. Lead flotation section containing two 44-in. double-overflow Fagergren cells
13. Conditioner, 5x5-ft.
14. Ten 44-in. double-overflow Fagergren cells
15. 60-ft. Dorr torque lead concentrate thickener. Concentrates, 31% lead, are mixed with those of sulphide lead-zinc mill section
16. American filter, 8½-ft., 6-disc
17. Concentrate storage bin, 150-ton
18. Truck to Lone Pine. Rail to Tooele smelter
19. Wilfley sand pump, 3-in.
20. Dorr dewatering thickener, 50-ft. (all mill tailings)
21. Denver duplex diaphragm pump, 4-in.

In the unoxidized zones, where the walls are hard or the vein narrow, open or rill-type stopes are common, and larger, hard sulphide orebodies are mined by sublevel stoping. Some shrinkage stoping is done occasionally. The sublevels are spaced at 21-ft. vertical intervals, and each level is developed to the limits of the ore before actual mining is started.

Modern drilling, mucking, and hoisting equipment and electric haulage are used throughout the mine. In drift and crosscut work, lightweight drills and airlegs are finding increased use, and tests with alloy drill steel and detachable tungsten-carbide bits are under way. In general, all drilling underground is done with high-carbon steel and detachable throw-away bits. Battery haulage is used.

New Unit for Mill

The flotation mill, a short distance below the portal of the Radiore tunnel, can treat up to 350 tons of sulphide lead-zinc ore a day. Of interest to visitors is the new 125-ton oxide lead-silver unit which was added to the mill about a year ago. It is to be described in detail later. Treatment of regular sulphide lead-zinc ores follows more or less standard practice. Ore drawn fom a 600-ton coarse-ore bin is reduced to minus ½-in. ball-mill feed in two stages, the equipment available for this work consisting of a 24x36-in. Traylor jaw crusher and a 3-ft. Symons Shorthead cone crusher operating in closed circuit with a 3x6-ft. Symons vibrating screen. Undersize is conveyed to a 350-ton cylindroconical fine-ore bin which is located at the head of the grinding department.

The Flotation

Grinding to about 75% minus-200-mesh is done in a 86 Marcy ball-mill operating in closed circuit, with a Dorr Model D duplex classifier, 8 ft. by 23 ft. 4 in. in size. The mill is driven by a 250-hp. synchronous motor and operates at 19.9 rpm. Classifier overflow (about 30% solids) after treatment in a 5x5-ft. conditioner goes to the lead flotation section containing two 4-cell No. 21 Denver flotation machines. Froth made by the first three cells constitutes finished lead concentrates which are subsequently treated in a 60-ft. Dorr torque thickener and 8½-ft., six-disc American filter. Middlings from the remaining five cells are pumped back to the head of the machine. Lead tailings are successively treated in two 5x5-ft. conditioners and two 4-cell No. 21 Denver flotation machines for recovery of zinc. The rougher concentrate produced by the eight cells is cleaned in a four-cell No. 21 Denver flotation machine, with the finished concentrates going to a 45-ft. Dorr thickener and 8½-ft. six-disc American filter and tailings to the conditioners. Tailings from the zinc rougher machines go to a second four-cell No. 21 Denver flotation machine. Froth from this machine is pumped back to the conditioners and tailings go to a 50-ft. Dorr dewatering thickener.

Lead to Tooele, Zinc to Great Falls

Filtered lead and zinc concentrates stored in 150-ton and 100-ton bins are shipped by rail from Long Pine to Tooele, Utah, and Great Falls, Mont. respectively. Transportation from the mill to Long Pine is by truck. Mill heads average 5% lead, 7% zinc, and 5 oz. silver. Reagents used include caustic soda, zinc sulphate, Minerec 201, Z-3, Z-6, copper sulphate, Aerofloat 15, B-23, MIBC.

In the Oxide Unit

The new oxide unit went into operation Sept. 10, 1951, and has given good service ever since. Its capacity is 125 tons per day. Equipment and treatment are shown in the accompanying flowsheet. The principal scheme of operation is to remove sulphide minerals before sulphidization in consequence of the depressing effect of sodium sulphide upon the flotation of sulphide lead and silver minerals. This is done by addition of xanthates, sodium silicate, and frother. Subsequently, the oxide lead minerals are sulphidized and floated by stage additions, from cell to cell, of sodium sulphide, sodium silicate, and pentasol amyl xanthate. Sodium cyanide is added to the ball mill to depress barren pyrite into tailing or to decrease the quantity of sodium sulphide required for sulphidization of the ore, or both of these.

Crushing of mine-run ore to minus ½-in. ball mill feed is accomplished in two stages by a 15x20-in. A-W jaw crusher and a Symons cone crusher operating in closed circuit with a 3x6-ft. Symons vibrating screen. The ball mill-classifier circuit consists of a 6x6-ft. Union Iron Works ball mill (overflow discharge) and a 36-in. Wemco SH simplex classifier. The classifier product overflowing at 31% solids and 72% minus 200 mesh is first treated in the sulphide flotation circuit. This consists of two 44-in. double-overflow Fagergren cells. Concentrates produced by the units go to the 60-ft. Dorr torque thickener handling concentrates from the regular sulphide lead-zinc mill section and tailings to a 5x5-ft. conditioner at the head of the oxide flotation circuit. Mixing the lower grade concentrates with those from the sulphide lead-zinc mill section brings down the overall grade of concentrate shipped to the smelter but in turn has obviated installation of a separate thickener.

Conditioned tailings from the two-cell sulphide machine undergo flotation for removal of oxide lead and silver minerals in a Fagergren flotation machine made up of ten 44-in. double-overflow cells. Concentrates produced by the first four cells (3-6 in flowsheet) are pumped to the 60-ft. thickener mentioned previously and middlings from the remaining six cells (7-12 in flowsheet) are returned to the head of the oxide flotation machine. Final tailings are pumped to the 50-ft. dewatering thickener handling tailings from the sulphide lead-zinc mill section. Settled material is removed at 58% solids by a 4-in. Denver duplex diaphragm pump and sent to the tailings pond.

Recovery 87%

Ore treated in the unit averages 7% lead, and overall recovery is 87%. Reagent details are shown in the flowsheet. Water for milling and camp use is obtained from Darwin Wash 3 mi. away. It is pumped from shallow wells into a 30,000-gal. tank by automatically controlled pumps. From here a 120-gpm triplex pump transfers the water in one 1,800-ft. lift through a 4-in. pipe line to 50,000-gal. storage tanks above the mill and camp. Electric power is obtained from the city of Los Angeles via the company's own power line terminating at the Olancha cut-off. The company has recently built a model town near the mine and mill, including an assembly hall and large swimming pool.

E&MJ expresses its thanks to F. A. Wardlaw, Jr., general manager, International Smelting and Refining Co., for permission to publish the aforegoing article. The help given by S. K. Droubay, resident manager, E. C. Peterson, mill superintendent, and J. H. Teel, metallurgist, in gathering the information is appreciated.

AURORA BOREALIS, nighttime manifestation of magnetic storms that come without warning and plague the airborne geophysical crews who have to re-fly traverse lines if data has been acquired during a magnetic spree.

Waboden Diary—A Story of Magnetic Storms Vs Airborne Geophysicists

WHAT HAPPENS to an airborne magnetometer team when it takes off from a base in Waboden, Manitoba, for a geographical survey in mid-winter? The answer is "Plenty!," as this condensed version of a diary reveals. Problems encountered include (1) landing fields in snowy terrain, (2) complex magnetic photographic, and electronic equipment that acts up in the cold, (3) snowstorms that prevent flights, and, worst of all, (4) the unpredictable magnetic storm that occurs without warning in any weather fair or foul and cancels many a weary hour of flying along traverses over Canada's northern wastelands. (Waboden is a small town 127 mi. northeast of The Pas, Manitoba.)

By Way of Explanation:

Diurnal. The intensity of the earth's magnetic field may vary as much as 75 gammas at any point daily due to a cyclic rising and falling of field intensity directly related with the position of the sun. Since the Gulf magnetometer measures intensities as low as 1 gamma, the geophysicist must naturally correct for these variations.

Gamma. A unit of measurement of a magnetic field—so sensitive that it amounts to only 1/100,000 of a gauss, the usual unit of magnetic field measurement employed in electrical equipment such as motors, etc.

Magnetic storms. Violent variations in the diurnal—so violent that they might falsely indicate large anomalies, if not properly observed and discounted by the geophysicist. Magnetic storms are often related to sunspot activity, and create disturbances in the ionized portions of the earth's outer atmosphere which show up as northern lights (aurora borealis) at night.

The Survey Crew

Tom Rowlands . . Party Chief
Bill Ferderber . . Pilot
Mac Cuddy . . . . Navigator
Mike Smith . . . . Magnetometer Operator
Alec Laxdel . . . Magnetometer Operator
Reg Hawk . . . . Mechanic
Eric Maul . . . . . Mechanic

Equipment

Gulf Model 2 Airborne Magnetometer
Avro-Anson CF-GRN Aeroplane.

MICHAEL BRIGGS-SMITH
Canadian Aero-Service, Ltd.
Ottawa, Canada

Feb. 15. Practically the whole day was spent in traveling 127 mi. by train, the Muskeg Special, from The Pas to Waboden. Inquiries about a dining car gained the information that the "newsey" on board was a bit of a cook, and could whip up some sort of a meal. These proved to be better than expected. After several inquiries it was definitely established that the train was supposed to leave at 9 o'clock, that it would certainly not leave before 9 o'clock, and that it might leave any time after 9 o'clock, so the crew got in and sat down. At 11:30 they were still sitting, but five minutes later the train took off at its 15-mph ordeal of starts and stops. Every locality boasting more than one tepee was the occasion for a stop during which nothing happened except a few people leaving the train for some fresh air. We reached Waboden at 8 o'clock.

Waboden is a scattered collection of houses and shacks that comprises the overnight stopping place for the Muskeg Special on its way to Churchill. A station and roundhouse make the town seem bigger than it is. Population is about 200, 75% of these being Indians or Breeds.

Ferberder, Hawk, and Cuddy who arrived by the Anson were waiting at the station with a caterpillar tractor and sleigh which was loaded with all the baggage. Led by the tractor, the crew went to the cabin that was to be headquarters. The plane had arrived that afternoon and was sitting at the edge of a new runway. To everyone's delight (surprise?), it had not sunk down to its antennae during its first landing.

Feb. 16. After breakfast, wiring of the Onan generator at the cabin was tackled so that a diurnal station could be started. Lacking a length of light cable to complete the job, Rowlands and Smith made a tour of the town to get some. The Hudson Bay store seemed to be the best bet. At the store Mr. Davidson said he "used to have some somewhere," and eventually produced a coil which he said must have been there "for about fifteen years." Lamps were the next difficulty. Five were borrowed from the owner of a generator at the small (and only) local hotel, who had his own generator. Each transaction took about an hour, and many questions had to be asked by the local people and as

MIKE BRIGGS-SMITH, author of this diary, came to Canada from England in 1949. He handled the data reduction job, and magnetometer operation.

THE MUSKEG SPECIAL takes off from Waboden, Manitoba, leaving behind the geophysical crew which has to set up camp, and install scientific equipment.

CABIN HOME OF THE CREW during their stay at Waboden. According to bush-camp standards, this place rated high, boasting double-tier bunks.

AVRO-ANSON CF-GRN wrapped up for the night. Airborne magnetometer rests in cradle beneath the plane, all set for traverse flights the next day.

PICKING POINTS—UGH! Once the magnetic profile is determined, the tedious job of matching magnetometer readings with identifiable ground points begins.

many vague answers supplied. The general feeling here is that tomorrow is another day, perhaps even better than today, and buying a can of milk may easily take an hour.

Well, to sum it up, the diurnal station was finally installed, and the next problem was to install the Herman Nelson heater. The mechanics who unboxed and installed it demonstrated the courage of two brave men who expected to perish in a terrible explosion at any moment. But—no explosion!—much to the onlookers' disgust. Actually the plant operated so well that a foot of air duct was burned off before the machine could calm down.

Feb. 17. Our first job was to run a cable from the Onan generator in the cabin to strip heaters bolted to vital equipment in the plane. When the heaters were tested, it was difficult to determine their effectiveness because the temperature was 20 above outside—but a flight was scheduled for the afternoon.

After lunch, the temperature arose to 30 above, and the test flight had to be postponed because the runway was getting soft. Our next problem was to find a room to develop film. After considering the few possible places available, the roundhouse of the Muskeg Special proved the best. It was ideal in all respects except that the film could not be dried there—so permission was obtained to use the engineer's washroom where running warm water was also available. By warm, we mean a system that injected steam into cold water so that a supply of water of any desired temperature could be obtained —in theory. In practice, the supply gave a steady flow of warm water with occasional bursts of superheated steam, a characteristic that lessened everyone's original interest in the shower located there.

Feb. 18. The runway was hard enough to try a test flight. Rowlands and Smith made the flight during which the magnetometer and radio altimeter showed signs of unsteadiness at first, but settled after 15 minutes. This indicated that a longer warm-up period was needed, but further testing was prevented because the plane started to ice up. In the afternoon the short film was developed in the roundhouse setup.

Feb. 19. Weather turned bad after nearly three weeks of unbroken sunshine. After lunch the diurnal station started to show signs of noise. Tests showed this to be due to the speed at which the generator was running and not due to magnetic storms. Changing the generator speed cleared this up.

During the day, Olshansky organized the exploration camp of the mining company, one tent of which was to be used for the data tent, and 1,000 ft. of cable were ordered from The Pas to run a 110-v. line from it to the shack. An attempt was made to erect the antenna outside the data tent (since there was a transmitter in the camp), but after Smith disappeared up to his waist, the project was postponed until we could find some snowshoes.

Flying Delayed

Feb. 20. Weather still bad. Flying impossible. After lunch more trouble showed up in the diurnal station. Due to a lack of spare 12J7 tubes in the first stage of the detector, the circuit was required to take 12SJ7's and a satisfactory match was found to bring this stage within the range of balance control.

Feb. 21 First survey flight was made, but had to return because the 400-cycle inverter in the magnetometer wouldn't yield a constant output. This inverter was exchanged with the one in the compass, and both worked well in a ground check. In the afternoon a full flight was made. On the ground, a 110-v. cable to the exploration camp was laid across the lake. A long lead was also made for the 28-v. A.P.U. so that it could be kept warm in the shack, and the lead run out to the plane when necessary. As the flight would produce the first full roll of film, a drying rack was constructed to suspend the film while drying. The spare altimeter was used on this flight, as the original one had given erratic readings on the short morning flight.

Feb. 22. This morning when it was hoped that the spell of bad weather was over, its place was taken by a severe magnetic storm. The temperature dropped to 10 below, not cold for this area, but a big difference from the mild weather experienced by the crew up to that point. The magnetic storm continued all day and prevented further flights.

Feb. 23. The magnetic storm continued. The air magnetometer was run on the ground as a check. A slight irregularity in this record was traced to a bonding on the power chassis which was corrected. The two records then agreed. But even so, no flights were possible. A tremendous display of northern lights that evening were beautiful to watch, but promised to play hob with the next day's diurnal.

Feb. 24. The magnetic storm still raged, although somewhat quieter. The air magnetometer was again run as a check against the diurnal recording. It was discovered that the paper-drive motor for the L&N recorder was not operating. So Rowlands moved the tape by hand, timing it to move about the same speed as the diurnal recorder (1 in. in four minutes). The two recordings agreed extremely well as to shape and magnitude, although in the opposite direction. This was not as serious as it might sound, as no attempt was made to correct the survey data from the diurnal data, which was used only to show the magnitude of disturbances. The fault in the paper-drive mechanism was found and repaired.

After lunch the magnetic storm subsided enough to permit a full flight, but even here, the last line was lost due to a sudden flare in the diurnal variation.

Feb. 25. Weather cold and clear, and the diurnal smooth enough to allow the first full day of flying. The morning's film was developed

during the afternoon, and afternoon flight film, that night.

Feb. 26. A morning flight was made even though the diurnal had still not settled down to a straight-line variation. In the afternoon a large pool of hydraulic fluid showed up under the plane. The mechanics spent the rest of the day fixing it.

Allowable Diurnal

As practically all flights up to this time had contained one or two lines that would have to be flown due to diurnal disturbances, the limits of allowable diurnal were discussed with Olshansky in the evening. Having seen the straight line that the ground station produced when first set up, he was not entirely convinced that the unsteady conditions at this time were the normal level of disturbance for this area that their persistence seemed to indicate. If this diurnal variation continued, and appeared to constitute the normal, "no-storm" level, he was willing to relax the limits he had set of about 15 plus or minus gammas curvilinear. Whether it was more economical to fly on doubtful days and except the reflights, or to keep the crew grounded was not definitely settled because it was felt that the variations might be part of a large magnetic storm that would eventually settle down.

Feb. 27. The morning started with the usual arguments about the diurnal, which itself settled the arguments by swinging into one of the most vicious storms recorded up to this time. At one time the gradient swung 300 gammas in less that 1½ minutes. But by lunch it quieted enough to make a flight worth trying. Shortly after take-off, it started throwing in occasional bursts well outside the limits, necessitating at least three reflights.

In the evening the diurnal position was again discussed. Olshansky agreed to let the whole day's survey stand for the time, but the lines flown during bad disturbances were to be listed so that if the storm died down in the future, they could be reflown; if the storm persisted throughout the survey, the lines would be accepted within broader diurnal limits.

Feb. 28. Another full day of flying possible, bringing total line-mileage to 2,500, or nearly one-third of the job. The last line of the day was lost because the camera ran out of film. Failure of the film-tension light to go out misled the operator.

Mar. 1. Weather good, diurnal sufficiently quiet in the afternoon to warrant flying the base lines. Smith was taken off the flying in order to have an extra man on data reduction which was lagging. Laxdal said he was willing to fly continuously, and Smith said — (censored!!).

Mar. 2. During the night one of the 110-v. leads came off the generator, and the equipment was cold when the flight started. This caused the film in the camera to stop for short periods during the survey, but not long enough to require reflights.

Mar. 3. Weather clear, two full flights possible. On reaching the area, trouble started with the magnetometer. The operator managed to locate the source, a burnt out ballast tube, just as the plane was preparing to return to base. The camera worked without any stoppages.

Mar. 4. Two full flights made without trouble.

Mar. 5. Weather good, two full flights possible. Regarding the weather, the bush pilots agreed that this was the best part of the whole winter, while the Wabodeners predicted violent winds and blizzards. On the previous evening the diurnal had settled down to such a quiet record that it made the records of the last two weeks appear like the fringes of a lengthy magnetic storm. On this morning it had settled down to a straight line, and it was sadly agreed that possible reflights that had been listed would probably have to be reflown.

Mar. 6. Dawn broke with a sweeping diurnal record, high wind and snow. No chance for a flight today.

Mar. 7. The snow practically stopped, allowing the drag to be started on the runway to clear the new snow and drifts. Hawk finally took over driving the caterpillar tractor, as the local drivers could not avoid digging holes when trying to start—a menace on any runway. Later in the day the roller was attached, but by evening both snow and wind returned.

Mar. 8. Light snow in the morning prevented a flight but allowed the tractor and roller to work. Clearing weather permitted an afternoon flight, but the last three lines were lost due to a sudden variation in the diurnal—amounting to about 300 gammas maximum. Diurnal variations are very steep in this area and seldom did a magnetic storm evolve slowly here, but quickly swung up to maximum amplitude.

Mar. 9. Weather clear, two flights possible. The diurnal behaved itself moderately well until 5 o'clock when a sudden shift nullified the last three lines of the day.

Mar. 10. Snow returned during the night. No flights possible. The roller was run in the afternoon, so that by the time the snow stopped, the runway was in good condition.

Mar. 11. Snow stopped, two flights made. When the film of the morning flight was developed in the afternoon, it was discovered that the fiducial flag had been inoperative 1½ lines from the end of the morning flight. This meant that the whole of the afternoon's flight would have the same fault, and the remainder of the afternoon was spent scribing lines on the emulsion of the film from the morning survey. A rough device was set up to do this, the number on the film being set to a line and then the fiducial being scribed on the emulsion from a fixed straight edge. Reluctantly we realized that this same job would have to be done for all the film exposed during the afternoon flight.

As soon as the plane landed, Rowlands dashed to the roundhouse to develop the film, while Smith tore the camera apart for repairs. In short, Smith soon made his repairs to the camera, and the film scribing took until 1 am to complete.

Thirty-Two Below

Mar. 12. Temperature dropped to 32 deg. below zero. With the run of good flying weather that had been encountered, attention of the crew now turned to speculation as to time of departure. By the time film and tapes had been edited in the afternoon, and remaining mileage calculated, it was found that one full flight should finish the job, including reflights.

Mar. 13. With the possibility of only one full flight left, the sight of a bad diurnal first thing in the morning was disheartening. About 9 a.m. the disturbance seemed to abate, and the engines of the plane were started up only to be shut down shortly afterwards, when the magnetic storm started to flare again. By midday the record was again quiet and the plane took off. During the afternoon, those left on the ground packed some of the magnetometer spares, while keeping careful check on the diurnal that became steadily worse. But later it was verified that all bad disturbances had occurred while the plane was in flight either to or from the area, or between line flights. In short all data was acceptable and the job was done.

New Ideas For Bagdad Copper

In expanding capacity from 3,500 to 9,000 tons daily, Bagdad proposes to use 60-ton trucks in its pit, Fluo-Solids roasting, and electrowinning in its plant. Mr. Dickie and his staff present plans for this most interesting development.

Photo courtesy Vinson Construction Co., Phoenix, Ariz.

BAGDAD'S EXPANSION will take place in area shown opposite. Orebody is in hill at left of pit; new plant site is at left of tailings pond; office and mill are in center. Road at right leads to townsite.

ERNEST R. DICKIE, General Manager
GEORGE GREEN, Mill Superintendent
OLAF HONDRUM, Mine Superintendent
GEORGE COLVILLE, Chief Engineer

WITH THE COMPLETION of negotiations on a copper purchase contract with the Defense Materials Procurement Agency, Bagdad Copper Corporation is proceeding with plans to expand its open pit mine output to 9,000 tons of ore daily from the present level of 3,500 tons. In so doing, several well-tested, but still quite new, techniques in mining and milling will be applied.

This article describes those techniques and tells how we plan to use them.

Bagdad's Past

By way of background, we might mention that Bagdad's orebody has been mined, at various times by several companies over the past 30 years or so. It was only under the present management, however, that Bagdad was regarded as other than a source of comparatively high-grade copper ore, to be mined by underground methods.

It is interesting to note, for example, that during the period prior to 1930 when the M. A. Hanna Co. was interested in the property, considerable work was done on applying electrolytic recovery methods to the ore.

After the depression, the property was reopened as a block-caving job, with a production of about 1,000 tons of ore daily. This ore was milled by conventional methods, the copper concentrate being sold to a smelter.[1] The property was mined successfully in this way for a number of years.

However, when the present management took over in 1944, ore reserves were quite low and costs had risen dangerously high. It seemed apparent that the only route to profitable operation lay in expanding production, and cutting costs, by going to open pit mining.

Accordingly, this was done, and at the same time a diamond-drilling campaign was launched to develop more ore. As a result, costs have been reduced, and ore reserves, which stood at 6 million tons in 1942, now total 30 million tons of sulphide ore averaging 0.754% total copper, and about 30 million tons of oxide ore carrying 0.435% copper. To completely recover the sulphide ore, this oxide capping must be removed, together with about 39 million tons of waste. The final waste-to-ore ratio will be 2.29:1.

Drilling the Ore

Because the Bagdad orebody lies in a ravine, conversion to open pit mining presented serious problems. From the first, it was our aim to use the largest-capacity and least-expensive units throughout the mine. The following is a summary of the mining methods we have worked out.

Following a long series of tests, we have settled on mining the orebody in 50-ft. benches. We use Bucyrus-Erie 27-T churn drills to put down 7-in. holes. Drilling speed in sulphide ore averages 50 ft. per shift with two bit changes per hole. In the softer oxide capping, speed goes up to about 70 ft. per shift.

The ore is a chalcocite-enriched zone in a gray monzonite porphyry. The drill tools weigh 1,600 lb.; the bits weigh 250 lb. new.

Blast holes are drilled in two or three rows along the bench, the first row set 10 to 12 ft. from the edge.

[1] *Engineering & Mining Journal*, Vol. 144, No. 6, p. 62.

ERNEST R. DICKIE, general manager, direct operations and planning.

BIGGER TRUCKS for cheaper haulage is Bagdad's aim. This 60-ton Dart being built for Bagdad has twin 350-hp. Buda engines, is reported world's largest.

HIGH CAPACITY was objective in trying this 45-ton Tournarocker being loaded by 4½-yd. P&H electric shovel.

FINGER-TIP POWER STEERING simplifies Howard Williams' job of spotting 500-hp. butane-powered Tournarocker.

Holes are spaced 18 to 20 ft. apart in the capping, 15 ft. apart in the ore. They are drilled to 5 ft. below grade, and 30 to 35 holes make up the average blast.

The powder foreman supervises the loading of each hole, varying the amount of powder to suit the kind of formation and the estimated burden. A typical charge in the 55-ft. holes in ore consists of 250 lb. Hercomite in 25-lb. sticks and 250 lb. Hercules 30% 25-lb. sticks in overburden. This amount of powder fills about 20 ft. in the hole, leaving 35 ft. for stemming. This charge is varied in amount, or is deck-loaded, to suit changing conditions. For example, a tight conglomerate in the east end of the orebody requires deck loading to secure even breakage throughout the depth of the hole.

Charges are fired by double strands of Primacord connected to a trunk line. Caps and fuse are attached to each end of the trunk line and are fired simultaneously, the aim being to guard against misfires. The foregoing methods yield good fragmentation, and secondary blasting is almost never needed.

New-Type Trucking

To haul ore economically up the Bagdad pit's grades, which occasionally have had to reach 15% plus, we felt we had to have highly-efficient, large-capacity trucking units.

After trying various types and sizes of trucks, we concluded that our most serious item of expense lay in maintenance of transmissions and differentials. Casting about for ideas to reduce this cost, we heard about the use of torque converters in powering oil well drilling equipment. Also, at about that time, the P. & H. shovels introduced their Magna-Torque drive, which applied a similar idea.

We then approached truck manufacturers with the suggestion that torque converters be applied to our trucks. We got little encouragement, the belief at that time being that a single-stage converter would only be about 75% efficient, and would run fuel costs very high.

Eventually, we got the Twin-Disc Clutch Co., Racine, Wis., to recommend their 3-stage converter for our job, and the Dart Truck Co., Kansas City, Mo., agreed to build four 30-ton trucks for us with the Twin Disc 3-stage converters installed. These trucks were delivered in December, 1950.

Use of the torque converter has proved most successful at Bagdad. Maintenance costs have been reduced materially. Transmission and differential failures are practically a thing of the past. Brake repairs

Table 1. Cost of operating trucks at Bagdad in 1950 and first ten months of 1952, in dollars per ton hauled

	22-Ton Euclid 15TD 1950	engines 54TD Jan.-Oct., 1952	30-Ton Dart 140[a] 1950	140TC[b] Jan.-Oct., 1952
Labor	$0.0163	$.02069	$0.0185	$.0856
Taxes	0.0006	.00078	0.0007	.00063
Vacation & Bonus	0.0007	.00003	0.0007	.00020
Tires & Tubes	0.0195	.03596	0.0156	.03046
Lubrication	0.0028	.00416	0.0039	.00384
Misc.	0.0069	.00828	0.0126	.00719
Maint. & Repair	0.0231	.03262	0.0386	.02964
Indust. ins.	0.0015	.00112	0.0018	.00129
Fuel	0.0075	.00956	0.0120	.00962
Total	$0.0789	$.11320	$0.1044	$.10143

[a] No torque converter. [b] With 3-stage torque converter.

1952: Av. round trip, 1.5 miles
Av. up-hill grade, 8% (loaded)
Max. grade, 14% (loaded)

TWENTY-TON Euclid climbs a 12% grade on roadway leading from open pit mine to waste dump.

PLANS FOR THE MILL are discussed by George Green, mill superintendent for Bagdad (right), and Gaylen Guest, mill foreman.

are down 75% owing to the downhill braking action of the 3-stage converter. Tire mileage has increased about 35 to 50%. In addition, engine life is longer because the torque converter permits running at a constant engine speed, regardless of grade or of load.

Note the comparative costs given in Table 1. At present, the cost of hauling ore with the Euclid 54TD, 22-ton trucks, is running 11.32¢ per ton; cost with the Dart 30-ton trucks with torque converter is running 10.143¢ per ton. Average grade on which these trucks haul is 8%.

When the underground mine was converted to an open pit, provision had to be made to elevate ore to the mill from the lower benches. Rather than try to truck it up very steep grades, we chose to put in a conveyor belt from a central dumping point in the pit.

Ore trucks dump into a hopper and the ore is fed into a large crusher from where it is then stored in an 8,000-ton glory hole. The ore is then drawn from this storage by means of a variable-speed apron feeder which discharges onto the 30-in. conveyor belt 1,000 ft. long, which operates over an incline of 17.5 deg. up to the mill. Belt speed is now 285 fpm, but when the expansion program is completed, this speed will be doubled.

The mill flowsheet includes conventional crushing, grinding, and flotation of copper and molybdenum sulphides. Reagents and typical metallurgical results are shown on p. 93. No difficulty is experienced in producing a copper concentrate assaying about 34% Cu with a recovery of about 92% of the sulphide copper, or 85% of the total copper.

The molybdenum flotation concentrate, which is re-ground before fi-

Table 2. Present and planned mining equipment at Bagdad Copper Corp.

DRILLS—exploration
- Christensen—1-S surface drill
- Knight & Stone—Screfofeed, 2,000 ft., AX.

DRILLS—blasthole—At Present
- 2—Bucyrus-Erie 22-T, 7-in. hole
- 2—Bucyrus-Erie 27-T, 7-in. hole

On Order
- 4—Bucyrus-Erie 27-T

SHOVELS—At Present
- 1—P&H 1400, 4½-yd., electric
- 1—P&H 1055, 3½-yd., electric
- 1—P&H 1055, 3½-yd., diesel
- 1—Northwest, 2½-yd., diesel
- 1—Bucyrus-Erie ¾-yd., diesel

On Order or Planned
- 1—P&H 6-yd., electric
- 1—Electric, 3-yd.

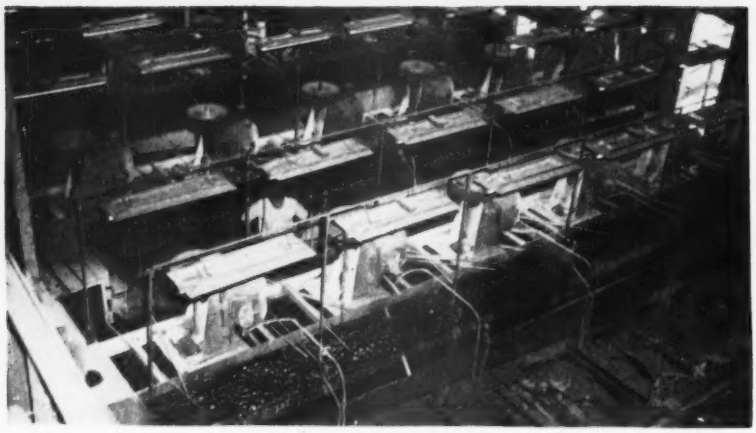
TRACTORS—At Present
- 1—Caterpillar D-8 dozer
- 1— " D-8 hydrodozer
- 1— " D-4
- 2—International Harvester TD-24 bulldozer
- 1—Tournadozer

On Order
- 1—International Harvester TD-18

TRUCKS—At Present
- 6—Dart 140, 4 with Twin Disc torque converter, 30-ton
- 6—Euclid 15TD, 20-ton
- 4—Euclid 54TD, 20-ton, with 1-stage torque converter
- 2—Tournarockers, 40-ton
- 1—Crane truck
- 1—Euclid 15-ton water wagon

On Order
- 6—Dart 60-ton, Twin Disc torque converter, two 350-hp. Buda engines

MISCELLANEOUS
- 1—LeTourneau Carryall, 11-yd.
- 1—Ripper
- 1—Adams Grader



COPPER FLOTATION is straightforward, with only slight problem from native and oxide copper. George Vega, operator, checks Fag roughers.

nal cleaning, carries about 93% MoS_2, with about 0.5% Cu. The American Cyanamid "Nokes Reagent" is used to float the molybdenum. Recovery is about 75%.

Contract Brings Changes

We had planned to expand production for some time, and we had also planned eventually to find some way to produce copper wire bars right at our property. The DMPA contract now makes it possible.

This contract, which runs until June 30, 1962, calls for purchase by DMPA of 27 million lb. per year of our copper at a floor price of 24½¢ per lb. The contract also calls for purchase of 940,000 lb. of MoS_2 concentrate yearly at 60c. per lb. Total expenditure required to carry out our expansion program will be $14 million.

Briefly, we plan to increase mill tonnage from 3,500 to 9,000 of sulphide ore per day. Copper concentrate will be roasted in a Dorrco Fluo-Solids reactor and leached by a counter-current decantation system. The roaster will be operated to produce the maximum possible amount of copper sulphate.

The solution from the leaching plant will go to an electrowinning plant, copper from which should assay 99.9-plus%. This metal will be melted and cast into wire bars at the property.

Leach residues very high in iron, could be sold as high grade iron ore, or possibly used to provide sponge iron to precipitate copper from the leaching of our oxide ore dumps.

Acid-bearing solution from the electrowinning plant will be sprayed on dumps of the low-grade oxide ore. Solution coming off the dump will be passed over iron, and the resulting cement copper will be redissolved and added to the solution going to electrowinning plant. Details of the expansion program appear in the following discussion.

First of all, the expansion program was made possible only by locating sufficient ore. This was done in part by about 40,480 ft. of churn drill holes, 115 in all, drilled prior to 1927, and in part by 149 diamond-drill holes, totaling about 54,000 ft., drilled since 1946. The churn drill logs were insufficient, in that they did not reveal the bottom of the potential orebody and showed only total copper.

The diamond drill holes, mostly vertical, were continued in depth until sludge and core samples assayed less than 0.4% copper. All were drilled with AX bits, except that in 1950 the practice was begun of putting in the first 50 to 100 ft. of each hole with BX bits.

In computing ore reserve tonnages, the orebody was broken up into 50-ft. bench levels. The map of each level was then subdivided into areas in which the drill hole assays had approximately equal weight. Tonnage and grade were then calculated for each area, based on the drill assays.

Churn drill assays were used as is. Diamond drill assays were corrected by using a modification (to suit Bagdad's conditions) of the Longyear weighting-factor graph. The Bagdad method gives about 20% more weight to the core assay than the Longyear method.

Thus far, tonnage and grade, as mined have checked closely with the calculated figures for ore reserves. Table 4 gives examples of this data.

The orebody, which lies in the area indicated in the aerial photograph, will be mined in 50-ft. benches. The uppermost bench in sulphide ore will lie at an elevation of 3,230 ft. The lowest bench in ore, which is two benches below the present pit bottom, will be Bench 10 at an elevation of 2,880 ft.

Larger Trucks Planned

In mining, under the expansion program, the chief innovation will be the use of six 60-ton Dart trucks with 3-stage torque converters. These trucks will have two engines (the Buda 350-hp., supercharged engine) and dual transmissions and differentials and no transmissions. Most of the parts will therefore be interchangeable with the 30-ton units now operating.

The three Tournarockers, which can haul 45 to 50 tons each, will continue in service. These are powered by 500-hp. Allison engines burning butane.

Shovel equipment will include that shown in Table 2 plus the addition of a 6-yd. P & H now on order. Another 3-yd. electric shovel may be purchased in late 1954.

Total costs, including everything attributable to shovel operation, have run as follows, for January through September, 1952: the P & H 1400, 4½ yd. electric, 2.1c. per ton loaded; the P & H 3½-yd. diesel, 4.9¢ per ton; the P & H 3½-yd. 1055 electric, 3.6¢ per ton. Production on these shovels varies between 3,800 and 7,000 tons per shovel shift.

Sulphide ore will be delivered to the conveyor belt glory hole, as it now is. Oxide ore will be placed as back-fill in the worked-out portion of the open pit, and will also be dumped into a nearby ravine where it can conveniently be leached. All this oxide ore will be subjected to heap-leaching.

Waste will continue to be dumped across the canyon above the pit, to act as protection against flash floods, and at one side below the pit to help impound tailings.

Treatment of Ore

The additional capacity needed for the mill will be provided by purchase of three more 10½ x 11-ft. ball mills, with classifiers, and by purchase of the required number of flotation cells. No basic change is planned in the present flowsheet. It will simply be necessary to supply all the various items to increase present capacity of 3,500 tons daily to 9,000 tons.

It is estimated that the mill will produce about 225 tons per day of concentrate running about 30 to 33% copper, 23% iron, and 9% insol. This concentrate will be roasted

Table 3. Typical metallurgical data and reagent consumption, Bagdad Copper Corp. mills

(Average for a recent month.)
Tons Treated Per Day (Avg.)—3,583

Product	Assays, % Total Copper	Oxide Copper	Sulphide Copper	Iron	MoS_2
Feed	0.819	0.147	0.672	2.001	
Tailing	0.192	0.133	0.059	1.573	
Copper Con.*	33.989			22.247	0.723
Indicated Copper Recovery	76.98		91.49		

* Insol. is 9.890%

Table 4. How calculated assay values, based on drilling, compared with assay values as mined.

Mine Area	Tons Mined	Calculated Assay, % Cu.	Actual Assay, % Cu.
Bench 8, Area 4,	303,905	0.640	0.622
Bench 7, Area 3	294,786	1.040	0.961
Bench 7, Area 74	183,907	0.880	0.870
Bench 6, Area 5	102,496	0.760	0.760
Bench 6, Area 4	99,024	0.900	1.434

Reagents	Consumption lb./T. of ore	Reagents	Consumption lb./T. of ore
Lime	5.500	Xanthate, Z-6	0.009
Xanthate, Z-4	0.109	Pine Oil	0.097
		Alcohol Frother	0.078

in two 22-ft. diameter Dorrco Fluo-Solids reactors in parallel:

These will be operated to produce as high a percentage as possible of sulphate copper in the calcine. About 75% of the copper will be discharged as $CuSO_4$, and about 22½% of the copper will leave as acid-soluble CuO. Recovery should be about 97% of the copper in the Fluo-Solids feed.

The reactors must be closely controlled. Because control is achieved by water sprays, the moisture content of the feed must be uniform. Therefore the copper flotation concentrate will be thickened and filtered, then repulped and fed to the reactors at a uniform moisture content of 80% solids.

The calcine will be leached in a counter-current decantation plant much like a standard CC_4 cyanide plant. The chief difference will be that construction will be acid-proof, the agitating mechanisms, for example, being of stainless steel.

Solutions going to electrolysis will carry about 40 gpl of copper and a trace of free SO_4. The spent solution from electrolysis will carry less than 3 gpl of copper and 6 to 8% SO_4. The latter figure depends somewhat on how much acid proves to be consumed in leaching acid-soluble copper in the oxide ore dumps.

We plan to use about 20 amp. per sq. ft. of cathode area. This figure will be maintained as high as possible through the circuit and still yield a firm deposit. We expect to obtain 100,000 to 150,000 lb. per day of cathode copper, also an amount of solution that should equal about 75 tons daily of 100% SO_4 available for leaching. Anodes are to be of antimonial lead; starting sheets will be made at the plant.

Solution from electrolysis will be diluted with about 15 parts of water. Part of this will return to the leaching plant, but the greater part will be further diluted to less than 0.5% acid to be sprayed over the oxide copper dumps.

Heap-leaching has already been tested on a 40,000-ton pile of oxide ore at Bagdad over a 3-months' period. Results indicate that recovery of copper will begin almost as soon as leaching starts.

Solutions flowing from oxide dumps will go to tumbling barrels for cementation with shredded tin cans or sponge iron. In disposing of the resulting cement copper, we have three choices. We can: 1, ship the copper to a smelter; 2, dissolve it with ferric sulphate and sulphuric acid; 3, add it to the flotation concentrate to be roasted to a soluble form.

Sponge Iron Considered

Because the leach tailing will have the analysis of a high grade iron ore, it is possible that we may give this product a reducing roast with a view to producing sponge iron to be used as a copper precipitant. A decision on this point must await developments.

Our work thus far indicates that all the foregoing processes will work out to achieve a balance among copper, acid, and iron production. We plan to mine, and leach, only enough oxide copper ore during any period to use up the free acid then being produced. At our planned rate of mining sulphide ore, we should produce about enough iron to precipitate the copper produced by leaching the oxide ore. Our plans are flexible, and the process can be modified to suit future developments.

Metallurgical testwork for the roasting, leaching, and electrowinning process was carried on by the Dorr Co. at Westport, Conn. Western-Knapp Engineering Co. has the contract for construction of the plants and for installation of equipment for milling, roasting, leaching, and refining.

New Town Built

Our expansion program also requires moving the rest of the Bagdad camp from its old location deep in the canyon up to the new Bagdad townsite about 2 miles away. We are also arranging for building additional stores, schools, and housing.

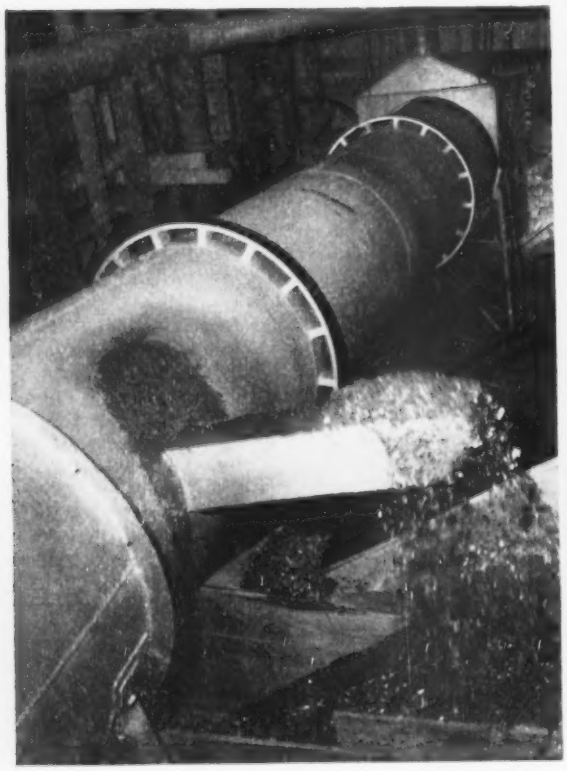
When in operation, the new project will employ about 450 men, and we look forward to the establishment of a town here of about 2,400 persons. Our aim will be, as it has been, to achieve the best possible living and working conditions in Bagdad, consistent with reasonably profitable operations.

Our program also calls for building a dam on Burro Creek 9 mi. away to impound flood water for use during dry seasons. This dam will be 200 ft. high and will impound about 30,000 acre-ft. of water. We now pump water to Bagdad from Burro Creek with electrically driven centrifugal pumps through 7½ mi. of 10-in. line over a vertical rise of 1,100 ft. When the dam is completed this pumping equipment will be duplicated.

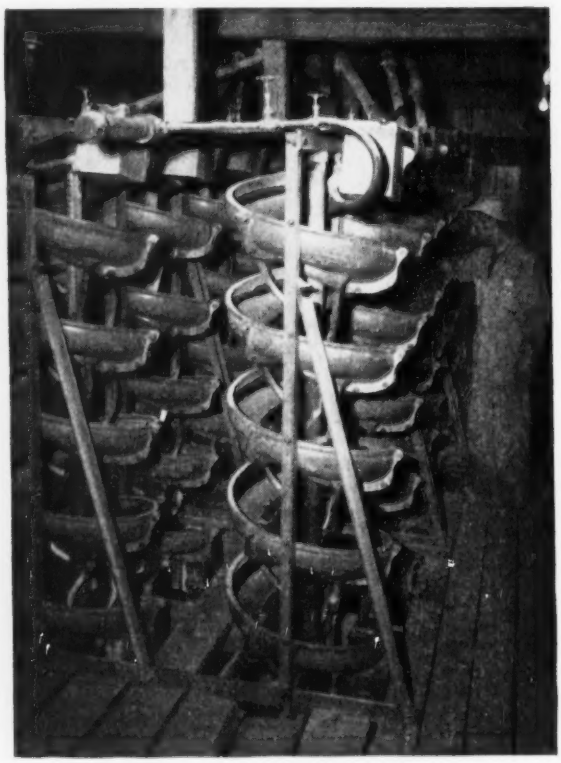
The road from Bagdad to Hillside (our shipping point on the Santa Fe Railroad) is being improved and oiled by the Bureau of Public Roads. Funds for this project were advanced by Road Access Funds, by Yavapai County, and by mine operators in the Bagdad area (Eureka mining district).

We wish to acknowledge the wise leadership and firm encouragement through all the stages of this project of Mr. J. C. Lincoln, president of Bagdad Copper Corp., Mr. Frank Snell, vice president, and Mr. R. H. Jamison, secretary, and Ernest R. Dickie, treasurer and general manager. Our sincere thanks go also to every staff member and employee of Bagdad whose hard work and enthusiasm are putting these plans into effect.

MOBILE SCRAPER and bulldozer team up to mine mica in the Kings Mountain Mica Co.'s open pit at Kings Mountain, N. C. Deposit covers 50 acres and has been opened to a depth of 55 ft. Total ore depth is undetermined

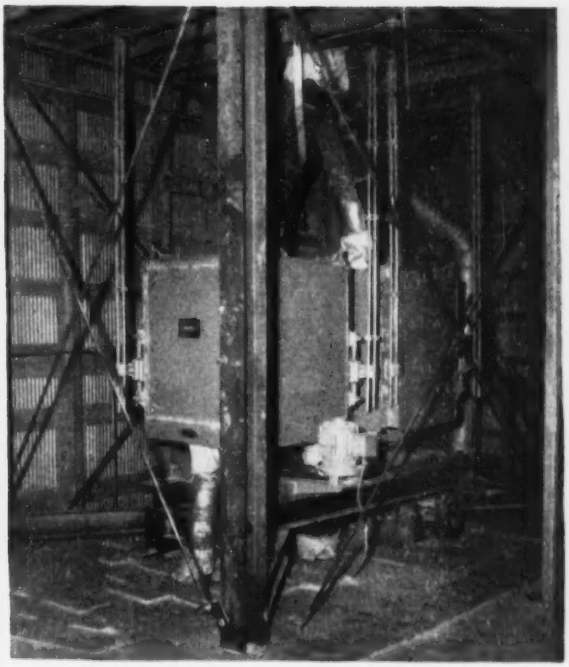


DRYER automatically scoops up scrap mica as it flows from the trommel screens in plant No. 1.



HUMPHREY SPIRALS, 20 in number, clean out sands. Middlings are reground and the concentrate deslimed.

PAUL A. LANCASTER, plant superintendent, checks pure mica coming off company designed desliming machine.



GYRATORY SIFTERS in the dry mill (Plant No. 3) are equipped with 94 mesh stainless steel cloth.

Kings Mountain Mica Operation

E. DALTON WHITE
McGraw-Hill District Office
Atlanta, Georgia

MASS PRODUCTION of high quality mica from very low grade scrap is the profitable business of Kings Mountain Mica Co., Kings Mountain, N. C. Much of the credit for low cost production of a uniform product is given to unique processes developed at the plant, and equipment designed and constructed by company personnel.

The company processes mica in two wet plants and one dry plant, and is believed to be the only plant in the country with wet and dry processes in closed circuit. End products average between 95 and 100% pure flake mica. Waste material from Plant No. 1 is further processed in Plant No. 2 to reclaim 95 to 100% pure flake mica. Plant No. 3 is the drying and dry grinding unit where a bagged product is produced to the customers' specifications. Plants were built under the supervision of Paul A. Lancaster, plant superintendent.

Desliming processes employed and the arrangement of equipment and flow sheet in the dry mill have increased plant efficiency. Water used is recirculated through settling basins and reservoirs. This insures a constant supply of clear water.

Every particle of mica possible is reclaimed. The by-product, crushed quartz sand, is sold in the commercial market as building sand. It is a washed product 16 mesh in size.

Rate of feed to Plant No. 1 is 12 to 20 tons of mica rock per hour, the finished product output averaging half a ton per hour. The feed to Plant No. 2 is one ton per spiral per hour and the average output of mica concentrate 1 ton per spiral per 24 hours.

All production of Plant No. 1 is sold to wet grinders. The output of Plant No. 2 is processed to customer specifications in the dry mill.

All bagged material is shipped by truck to ultimate destination or to railhead at Kings Mountain, 2 miles from the plant. Trucks also transport the finished product to Charleston, S.C., 200 miles away, for water shipment.

The dry-grinding plant is a new addition and has a capacity of about 20 tons a day on a 24-hour operating basis.

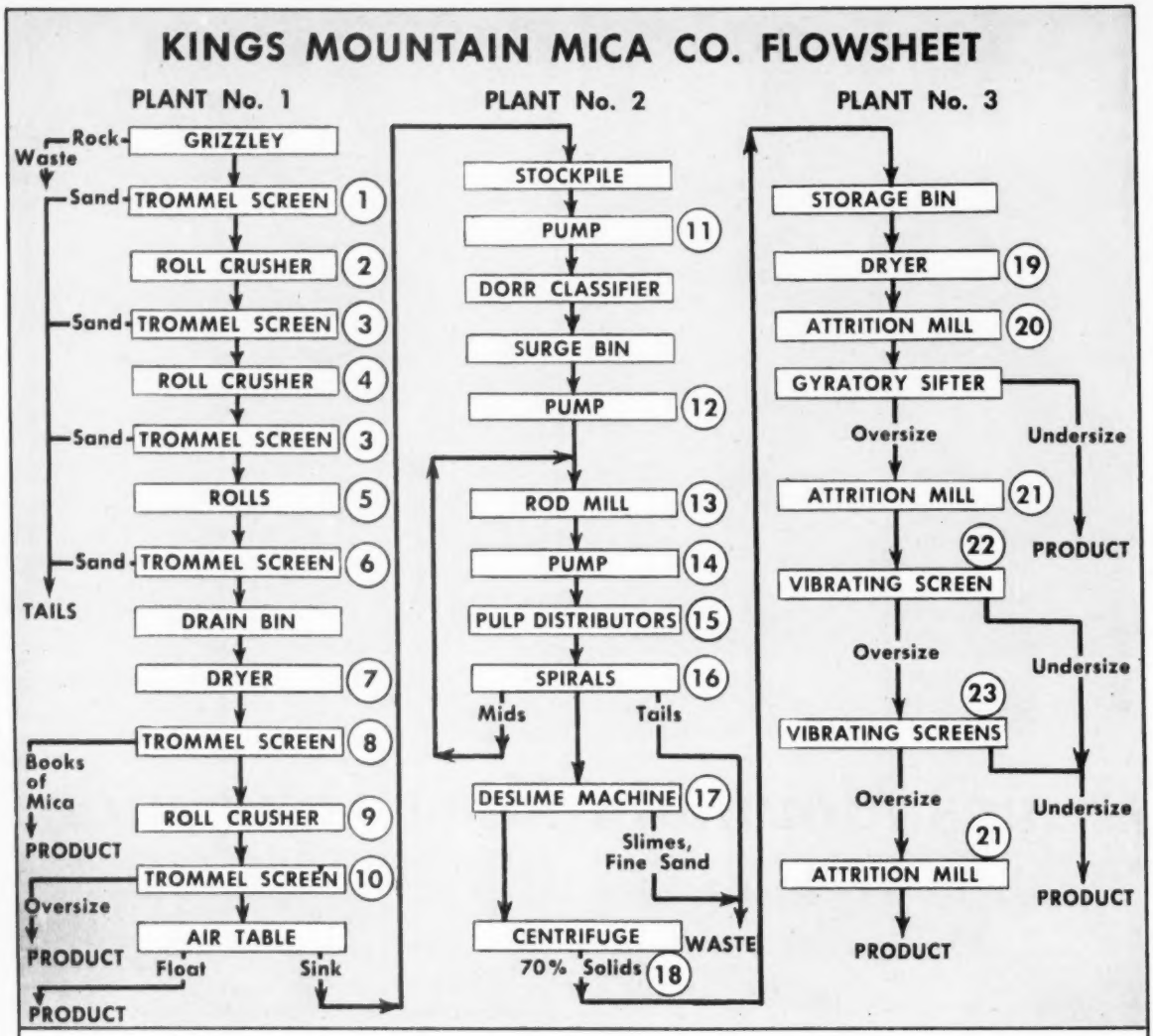
The main deposit comprises an area of about 50 acres and is of an undetermined depth. The company has gone down at least 55 ft. below surface and finds that the grade is maintained. The Kings Mountain mica delaminates better than most micas and a more flaky and lighter product is produced. What little overburden there is, can be bulldozed off or removed by mobile scrapers.

Mining is done in open pit, requiring little heavy equipment. Stockpiling, in excess of processing requirements, presents no problem.

A $\frac{3}{4}$-cu. yd. Bucyrus-Erie gasoline dragline is used primarily to excavate drainage ditches and water sumps throughout the mining area. The material dug is stockpiled along the open drain ditches and picked up by a scraper and carried to plant No. 1 stockpile.

These ditches are 15 ft. wide and 10 ft. deep to drain the orebody. Water in ditches and sumps is pumped out by a 3-in. gasoline Gorman-Rupp pump and piped to the reservoir for use in processing the mica.

Other equipment includes one International TD-18 bulldozer and two D-7 Caterpillars which are used as



LEGEND

1. 12-ft. x 30-in. trommel screen with $^3/_{16}$-in. opening.
2. 16 x 36-in. Allis-Chalmers roll crusher set to ¼ in.
3. 12-ft. x 30-in. trommel screen with ⅛-in. opening.
4. 16 x 36-in. Allis-Chalmers roll crusher set to ⅛ in.
5. 16 x 30-in. Sturtevant rolls set to ⅛ in.
6. 8-ft. x 30-in. trommel screen.
7. 26-ft. x 44-in. shop-built rotary dryer.
8. 8-ft. x 36-in. trommel screen with ½-in. opening.
9. 14 x 30-in. roll crusher set tight.
10. 8-ft. x 22-in. trommel screen with ⅛-in. square openings.
11. Kansas City 4-in. heavy duty pump.
12. Triplex 4-in. diaphragm pump.
13. 4 x 6-ft. rod mill.
14. 3-in. vertical sand pump.
15. 2 Denver 4-in. pulp distributors.
16. 20 five-turn 24-A Humphrey spirals.
17. Shop-built de-sliming machine.
18. 18 x 28-in. Byrd centrifuge.
19. 5-ft. x 35-in. Ruggles-Coles rotary dryer.
20. 24-in swing-head attrition mill.
21. 30-in. double-runner attrition mill.
22. One 3 x 10-ft. double deck vibrating screen; 8 mesh top, 84 mesh bottom.
23. Two 3 x 10-ft. double deck vibrating screens; 30 mesh top, 84 mesh bottom.

bulldozers or with a scraper. There is one HD Allis-Chalmers 'dozer with an 11-cu. yd. LeTourneau scraper.

The Kings Mountain company's plant is fortunate in having at least a 5-year supply of mica in storage from Plant No. 1 for processing in Plant No. 2. This means that inclement weather does not interfere with continuous plant operations. Ore storage at Plant No. 1 is kept at a minimum of one-month supply.

Mica rock from the stockpile is fed to the grizzly screen by playing water on the stockpile. The grizzly was designed and made at the plant with strips of angle iron set to discharge everything but ½-in. material. The books of mica easily slide through the openings. The oversize rock is discharged on to an endless belt conveyor and goes to waste. The quartz does not carry mica.

The flow sheet, including the thorough desliming process in Plant No. 1, by a series of trommel screens, is shown above.

The Kings Mountain Mica Co. plant is completely electrified. Electrical and mechanical maintenance is handled by its own staff. James E. White is chief electrician, and Marvin Lancaster master mechanic. The plant operates on a three-shift, six-day-week basis.

Despite Good Prices...

Interest Lags in Philippine Manganese

OPEN-CUT MANGANESE MINE at Guindulman, Island of Bohol, has been in operation since 1938. Equipment has been improved in postwar period.

WILLIAM F. BOERICKE
Consulting Engineer
25 Broad St., New York
and
NESTORIO N. LIM
Executive Secretary
National Chamber of Mines
Manila, P. I.

MANGANESE MINING is important in the economy of the Philippines and could become more so when peace and order again prevail in some of the more inaccessible parts of the Islands which have been virtually closed to prospecting since the war. In value of output, manganese is fifth among the principal metallic ores mined, being exceeded by gold, iron, copper and chromite.

The production data in Table 1 have been taken from the Philippine Bureau of Mines' Information Circular No. 10. Conversion of peso value into dollars has been made at the official rate of 2 to 1.

The production of 55,372 tons in 1941 was for 10 months only, as Pearl Harbor put an end to mining. Undoubtedly, if work had continued, the full year's production would have been over 65,000 tons, as the United States was calling for all ore possible. No manganese was shipped to Japan, an embargo having been declared.

About 10,000 tons of manganese ore was left in ore bins or stockpiles on the outbreak of war in December, 1941. This, of course, was seized by the invaders. The Japanese continued to operate the properties. No definite figures are available for their production during the war. When the Japanese were finally driven out in 1945, the mines had been robbed of their best ore and were left in poor operating condition.

Not until 1947 was production resumed on even a small scale. Japan was the natural market for Philippine ores because of its nearness, relatively, and its ore buyers' willingness to accept ore of lower grade than had been wanted in the United States. But so bitter was the postwar resentment against Japan, that no shipments were made for several years, and then largely because of the efforts of SCAP to restore prewar trade relationships. Japan became the chief buyer of Philippine manganese during 1950-52, replacing the United States. Several European countries had bought small amounts before the war but are out of the picture today.

Japanese ore buyers have some advantage in competing for Philippine manganese. Freight rates to Japan ports vary from $3 to $6 per ton, as contrasted with $8 to $13.50 per ton to the Atlantic seaboard, depending on the shipping season. Their ore specifications are less rigid than those of U.S. buyers. Typically, they will pay $0.96 per long ton unit for 48% ore, fob ship, with a maximum of 7% Fe, 18% combined SiO_2 and Al_2O_3, 0.2% P, and 0.2% S. This contrasts with the specifications of GSA for the same grade of ore of 7% Fe, 11% combined silica and alumina, and 0.12% P. For 40% ore with 38% as the rejection point, Japan was offering $0.70 per metric ton unit, dry basis, fob Philippine ports in 1952.

American buyers want high-grade ores and were offering $0.93 per unit fob vessel for 48% ore, $0.85 for 46%, and $0.70 for 42%. Producers sold more high-grade ore to the United States during the first half of 1952 and have been satisfied with the results of analysis and out-turn tonnages of their ores.

With the excellent prices now offered for manganese ore in contrast with prewar contracts, which averaged about $0.21 per unit in 1937-40, fob Philippine ports, it may seem surprising that production has lagged so far below capacity output. In 1938, Japan paid an average of $10 per ton for 46% ore and bought over 29,000 tons from a single producer. The same ore today would bring about $41 per ton.

In short, while postwar production has declined, the relative value has gone up substantially. The tonnage of manganese produced in 1951 was only 43% of that in 1940, but the dollar value was 90% of 1940, because of an average price more than twice as high as prewar.

Why Interest Lags

The lack of enthusiasm and the lagging interest in manganese mining ore has been ascribed to high labor costs, drastic import controls on equipment and supplies, and especially to the still unsettled condi-

Authors were associated in the Philippine Bureau of Mines before the war from 1938-41. Mr. Boericke was interned during the war and later returned to the United States. Mr. Lim took his place as chief valuation engineer for the Bureau of Mines until 1950 when he took his present position.

MANGANESE OCCURRENCES are numerous in the Philippine Islands. The island of Busuanga and Siquijor lead in these resources.

Table 1. Production of Manganese in the Philippines, 1937-1952 (June)

Year	Tons	Value	Av. Value per ton
1937	25,218	$247,700	$9.90
1938	58,143	549,350	9.40
1939	29,394	301,300	10.25
1940	52,166	710,200	13.60
1941	55,372	790,400	14.25
1947	3,322	54,250	16.40
1948	25,565	420,450	16.80
1949	26,288	472,100	17.80
1950	29,867	580,700	19.60
1951	22,343	641,900	28.50
1952			
Jan.-June	11,734	not reported	

Table 2. Recent Manganese Production Costs

	Amalgamated Minerals Busuanga	General Base Metals (Bohol)
Mining, depreciation, overhead, and administrative expense	$12.00	$7.50
Hauling, mine to pier	3.00	5.00
Loading in barges	1.25	0.25
Lighterage	6.75	none
Washing ore (beneficiation)	none	2.50
Total	$23.00	$15.25

Table 3. Typical Analyses of Philippine Manganese Ores

	Busuanga	Bohol Washed Ore	Siquijor Washed Ore	Masbate
Manganese, %	48.8	40.2	47.3	41.5
Iron, %	3.0	4.7	4.8	4.5
Silica and alumina, %	10.4	15.8	8.3	27.0
Phosphorus, %	0.14	0.14	0.13	0.018

tions in many parts of the Islands. These conditions are particularly bad in the remote sections where Huk disturbances, although less violent than formerly, are still a menace to prospecting and development work. Lack of facilities for bringing ore to the coast for loading, and the high cost of lighterage are additional deterrents for venture capital.

This venture capital must ordinarily be supplied locally. Philippine manganese deposits, although widely occurring, are seldom of a size that would attract large-scale investment, particularly from abroad. Characteristically, they are not unlike the deposits of Oriente province in Cuba. The history of the latter shows steady shipments to the United States from numerous small operations, all locally managed and presumably profitable. In the opinion of engineers who have examined Philippine deposits, most of them are of limited size with a recoverable tonnage that would not warrant installation of expensive equipment. The individual deposits can often be worked by hand mining methods on contract, with experienced supervisors that understand native labor.

Busuanga and Siquijor Lead

Although manganese deposits have been reported on nearly every major island, by far the greatest production has come, strangely, from two small islands difficult to locate on a map: Busuanga, of the Palawan group, and Siquijor, a subprovince of Negros Oriental. In 1941 Busuanga mines furnished more than 54% of total Philippine production and Siquijor about 38%. In 1951 Busuanga furnished 9,807 tons, or 45% of total shipments of 22,343 tons, but Siquijor had fallen to 18%. General Base Metals, Inc., a new important postwar producer, operating two properties on Bohol Island had first place in production with 7,568 metric tons. This company maintained its dominant position in the first six months of 1952. With shipments of 6,491 tons, it supplied over half of the total Philippine production.

In 1951 there were nine companies that reported shipments of manganese ore, five of which had mines in Busuanga, and the others in Bohol, Siquijor, Camarines Sur and Surigao. This by no means exhausts the list of potential producers that awaited capital to reopen them. Properties that have good prospects are located on Leyte Island at Baybay, on Masbate, and at Samar. The

Siec property in Ilocos Norte has some reserves of low-grade ore that might be beneficiated. Several interesting occurrences have been reported on the west coast of Mindanao. Neither Cebu or Panay Island can be dismissed. A particularly interesting exposure has been reported from Nueva Ecija in central Luzon, which appears to be similar to the rich Bani manganese in Camarines Sur. Because of its inaccessibility this area has never been thoroughly prospected but it has promise.

Transportation is a main problem of Philippine manganese miners. Few of the deposits are located within easy distance of the coast and trucking is required. Save in a few cases where ore can be loaded direct from pier to ocean carrier, the ore must be loaded into a lighter and towed to Iloilo, Cebu, or Manila for re-transfer. This is costly and accounts for a major part of operating cost.

Costs and Analyses

Some production costs are given in Table 2 for typical manganese ores mined. These include mining, hauling ore to tidewater, loading on lighters, lighterage to freighter, together with royalties, taxes, overhead, and depreciation. Any comparison must take into account that beneficiation expense varies at each property as well as trucking distance to tidewater. Costs are of recent date.

Overall costs at Seleo mines at Camarines Sur are reported as $17.50 per ton, and at Philippine Base Metals at Samar at $18.

At Busuanga mines, it will be noted in the table, the transportation cost, including lighterage, is heavy and comes to $11 per ton, or nearly half of the entire production cost. As compensation, Busuanga manganese requires little beneficiation except cobbing and can be shipped as mined.

Some typical analyses for Philippine manganese ores are given in Table 3.

The high-grade ore from Busuanga contains little moisture content and does not absorb it en route to the United States or Japan. On the other hand, concentrates and lump manganese from Bohol, principally soft pyrolusite, absorb moisture readily in transit. At the time of shipment such ore will run 6-8% moisture, but at destination it may run 12-20%. Another analysis showed 14% at the mine but 23% on arrival in Japan. The pyrolusite contains both fine and coarse material, of the spongy type. Such ore can lose moisture easily as well as gain it, but the sea voyage increases the water content and brings complaints from buyers.

Royalties Unchanged

Manganese operators pay royalties to claim owners at the prewar rate, usually a sliding scale varying between $1.25 and $1.75 per ton. For ore below 48% the royalty is $1.50 per ton, or about 3½% of the value. Lower grade ores, running 38-40%, pay a $1.25 royalty, and premium ores pay $1.75. The government collects a production tax of 1.5% of the gross value of the ore loaded on freighter.

Washing Simple

Beneficiation methods for manganese ores are usually of the simplest character. At Bohol, low-grade ore is washed by hand, using either sea water or fresh water to bring the manganese content up to 38-41%. From a stockpile at tidewater, the ore is wheeled to boxes where sea water is sprayed on it. The ore is turned over by shoveling until all the soil is washed away. The concentrate remaining is plus-10-mesh to ½-in. in size, and, as noted, carries high moisture.

At Siquijor the ore is run through Bendelari jigs, which have been able to raise the grade of concentrates to 46% from material that averaged 30-38% Mn. Before the war a modern concentrator using jigs, tables, and flotation machines was employed on this ore. Log washers were tried on nodular material at Ilocos Norte, but were not particularly helpful in improving recovery. Slime losses were high.

The geological characteristics of the principal manganese-producing areas can be summarized briefly. The deposits may be primary, or more commonly secondary, with the ore occurrences residual or detrital. Orebodies are usually tabular in form, as lenses or as fissure fillings but in some localities nodular ore is common. Chert, jasper, and limestone are commonly associated with the manganese.

In Busuanga, generally similar geological features are encountered. Ore is found in folded structures with walls of bedded chert and jasperoid. Faulting is extremely common which makes estimates of probable and possible ore extremely hazardous with liability of considerable error by even experienced engineers. Estimates by claim owners are usually absurdly exaggerated. Orebodies are tabular or lenticular with thickness varying from thin seams to 7½ ft., averaging about 3 ft.

The Siquijor deposits are located on the northeast part of the island. Three types of occurrence are known, primary sedementary, replacement, and residual. The primary type is the most extensive, and is usually found in the shales in contact with the agglomerate basement. Ore thickness seldom exceeds 6 ft. Cavity filling in limestone occasionally furnishes considerable ore and, in at least one instance, a large tonnage was recovered from a residual deposit.

On Bohol, the manganese occurs in association with limestone and andesite rocks, and is also found as massive nodules and in manganiferous earth. The high-grade nodules are encountered as accumulations upon eroded limestone or disseminated through soils derived from them.

According to an estimate of the Philippine Bureau in 1950, total manganese ore reserves amount to 481,000 tons, of which over 60% are credited to Bohol. In our opinion, this estimate (if considered as proven and probable ore) may be too high. However, it should be borne in mind that in no sense would such a figure represent the ultimate tonnage that could be mined. Vigorous and intelligent prospecting in areas with favorable geology that already have a history of production is almost certain in the opinion of the Bureau of Mines to result in new discoveries.

Profitable But Small Scale

Manganese mining in the Philippines would appear to be quite a profitable business. With average production costs of about $20 per ton and selling prices about $40, the profit margin seems ample. However, it must be pointed out again that the average size of the ore deposits does not warrant large-scale operations. The average local operator has been inclined to work his ore out with all possible speed and neglect development and prospecting work. As a result, when the orebody is exhausted he has no other reserves to turn to and is inclined to call it a day. If he is inclined to try again, he must start from scratch, with the usual mining chance against finding immediately a new profitable deposit.

In the preparation of this paper we wish to acknowledge use of material from the Philippine Bureau of Mines.

KEEPING TAB ON PRACTICE

Bigger Dippers, Giant Trucks and New Drills Feature Current Open-Pit Mine Operation

OUTSTANDING AMONG NEW developments in current open-pit mining practice is the mammoth 60-ton off-highway truck built by Dart Truck Co., Kansas City, Mo., called the world's largest truck. In addition to further brief mention of this equipment on the page opposite, the new transport unit is discussed in the article on the enterprise of Bagdad Copper Corp., prepared by E. R. Dickey and members of his staff. The article appears on pp. 88-93 of this issue.

Changes in practice mentioned by major open-pit operators are summarized briefly as follows:

Mine No. 1, in Southwest

Stripping. Investigation of 6-cu. yd. shovels versus 5-cu. yd. demonstrated favorable improvement in loading rate. More extensive application of truck haulage is noted to meet waste disposal requirements and in bench development.

Drilling, Blast Hole. Changing from 9-in. churn drill holes to 12-in. for primary bank blasting, thereby permitting increased distance between holes and decreasing footage drilled. Improvement in tons broken per pound of powder with no increase in cost per foot of hole drilled.

Blasting. No change in explosives but loading is modified to the extent occasioned by adoption of 12-in. holes.

Digging Ore, Loading. Drop-cuts for development of new levels in bottom of mine are now opened with 25-ton trucks and material transferred into railroad cars. Reduction in blasting and track-laying expense more than offsets cost of dual transportation units. This system makes possible great intensity of operation.

Two new 6-cu. yd. shovels put into service during the year. Standard dipper size previously has been 4½ cu. yd.

Transport. New models of trucks are equipped with three-stage torque converters, which results in lower maintenance costs and better control of loads on downgrade hauls, due to braking effect of torque converter.

Accessory Equipment. Self-propelled, rubber-tired air-drill unit mounting 4-in. drill with 18-ft. change has recently been added. Unit is self-contained, carrying heater, fuel and 315-cfm air compressor.

Mine No. 2, in Southwest

Drilling, blast-hole. Use of self-contained, piston-type, primary blast-hole drilling machines for drilling 6-in. blast holes at relatively close intervals in hard, blocky conglomerate has been expanded. This type of drilling replaced 9-in. churn drilling in this formation.

Large churn drills equipped with heavy tools and 12-in. bits and drilling at increased intervals continued to replace smaller churn drills with 9-in. bits in monzonite, diorite and rhyolite.

Rotary drilling tests started during 1952 were being continued with one machine at the end of the year.

Digging ore, Loading. Two new 6-cu. yd. shovels were put into service. Standard dipper size previously has been 4½-cu. yd.

Transport Trucks. A small fleet of 18-cu. yd. dump trucks was put into operation in 1952 to supplement rail haulage. They are used for re-opening old mining levels and for waste removal from upper levels where hauls are relatively short.

Rail-haulage equipment was increased with addition of one 1750-hp. diesel-electric locomotive weighing 125 tons.

Mine No. 3, in Western State

Drilling, Blasting. A heavy leyner-type drill with compressor mounted on D-7 Caterpillar tractor for mobility is used in drilling leyner holes for bank blasting. This is the same type of equipment as that now being used in an open-pit mine in Utah.

(Caterpillar Tractor Co. has developed a tractor-mounted drill rig for quarries and open pits. A trend to increased use of this type of rig is indicated. The rig is mounted on Caterpillar D8 and D7 tractors, the drill being on the front and taking its power from the tractor's front power take-off. The compressor is mounted on the rear, and is powered by the rear power take-off. This development has eliminated manual drill handling as well as need for a central compressor with long feeder lines. One large stripping operator who has switched from wagon drills to tractor-mounted rigs is said to have increased footage from 112 to 343 ft. per crew per shift. Another operator, drilling 28-ft. holes in ore and limestone, is said to have cut cost per foot drilled from 0.301¢ to 0.090¢.)

Mine No. 4, in Southwest

Transport. Some ore is being transported by bulldozers and Carry-all scrapers to a transfer for haulage underground. Trucks also dump into transfer, eliminating long up-hill haul for ore than can be handled in this way.

Mine No. 5, in Southwest

Blasting. Change has recently been made to paper casing, 9-in. inside diameter, for blast holes. It effects an appreciable saving in cost.

An Iron Country Operator

Haulage and Transport. 1. Mechanical tie-tampers are being used for laying and maintaining mine trackage.

2. Use of two-way radio to dispatch mine locomotives is being expanded.

3. Tandem diesel-electric locomotives are being used for open-pit haulage.

4. Side-dump, air-operated cars, 40-cu. yd. capacity, are being used for moving ore in and around pits.

Drilling. Induction heating is being used to aid in sharpening churn-drill bits. It provides a faster and more uniform heating of the bit.

Blasting. Milli-second Primacord connectors are being employed. This provides greater efficiency with less earth shock.

Sampling. A core barrel for taking samples in soft material is being used.

Mine No. 6, in Northwest

Drilling. In this pit with 40-ft. benches, primary drilling is being done by a Joy 58BH rotary drill to 44-ft. depth, putting down 6-in. holes without casing. Hughes heavy-duty tricone carbide-tipped bits are used. Bit penetration is 11 ft. per hour of actual drilling time, bit life 400 ft. Cuttings are saved for sampling. These holes are fired with Primacord and millisecond delays. In areas where it is not logical to operate this drill, ground for primary breaking is drilled with wagon drills using 2½ to 2¼-in. detachable steel bits and blasted with electric primer and lead wire system, the charge being deck-loaded, upper half 45% strength, lower half 60%.

Mine No. 7, in Ontario

Stripping. Bethlehem Steel Co.'s new mine at Marmora, Ont., is equipped for stripping 30,000 tons of rock daily (total 20 million) to 100 ft. depth with three 6-cu. yd. electric shovels and 20 22-ton heavy-duty Euclid trucks. Ore grade is a little under 40% iron. Output planned is half a million tons per year for 25-30 years. Pit will be over 0.5 mile long, 0.25 mile wide and as much as 500 ft in depth.

Big Truck Here

Biggest Heavy-Duty Truck. Dart Truck Co. has built a 60-ton off-highway truck. The new unit is powered with twin diesel engines, totaling 700 hp., positioned one on each side of the under belly of the truck in the center. A photograph of this truck is shown in the Bagdad article, page 90 of this issue.

Cold-Weather Starting. Attention is being given to facilities for starting open-pit diesel-powered equipment in cold weather. These include compressed-air starters (such as those of Ingersoll-Rand) and vehicle heaters (such as that of Stewart Warner).

Trucking in Tennessee Phosphate Field. The trend toward the use of larger dump trucks for hauling phosphate matrix for mines to washing plants continues. Maximum truck size operated on public roads is limited by Tennessee State regulations concerning vehicle dimensions, axle loads and total gross vehicle weight. Axle load limitations force the use of trucks with twin rear axles, each powered.

Rapid Acceptance of Torque-Driven Truck. According to Euclid Road Machinery Co., its first 22-ton torque-driven truck was delivered in May of 1951. Acceptance was rapid and during 1952 fleet deliveries in the mining industry became common. They were made to iron, copper and lead mines, with iron mines predominating. This acceptance was one of increasing sales on applications where 22-ton units best fit into operations. Major reasons appear to be: Ease of handling; steady flow of power; maximum effective power on grades; cutting down hauling-cycle time; less wear and tear on the unit; and outstanding driver acceptance and comfort.

Blasting. For leg wire insulation in open-pit and overburden blasting Atlas Powder Co. has developed what it calls its "Twinplex assembly." This consists of a plastic sheath that encloses and protects the leg wires of two duplex E. B. caps. It is specially made for detonating deep blast holes from the bottom of the hole—the point of maximum confinement—as recommended in the Rockmaster blasting system. The additional protection of the Twinplex sheath is said to be proving of great benefit where rough stemming or jagged holes are encountered. It makes it easier to use caps in the bottom of the holes and get the maximum milli-second delay effect in their blasting.

Use of Jet Piercing Grows

THE USE OF THE JET PIERCING process has been extended by Linde Air Products Co. to crushed-stone quarries where it is being used to pierce blast holes in much the same way as has been done on the Mesabi iron range in Minnesota for several years. Blast holes about 6 in. in diameter are made at speeds of 22 to 25 fph.

The machine is simple, fairly small and inexpensive compared to the 40-ton JPM-3 used on taconite. At present, converted churn drills are being used for the quarry work. However, a manufacturer of heavy machinery is considering producing a standard small-size, low-cost machine for quarry work. Jet-piercing is also being used in dimension-stone quarries for pressure-relief.

Arrival of the JPM-3 jet-piercing machine at Reserve Mining Co.'s property, at Babbitt, Minn., on the Mesabi, was announced last June. With it the size of holes that could be pierced was increased to 7½ in. in diameter and to 47 ft. in depth. The 7½-in. holes can be pierced at about the same speeds as the 6½-in. holes previously pierced. Piercing progress is controlled automatically.

The JPM-3 machine is the successor to the JPM-1 machine in service at Erie Mining Co.'s taconite mine.

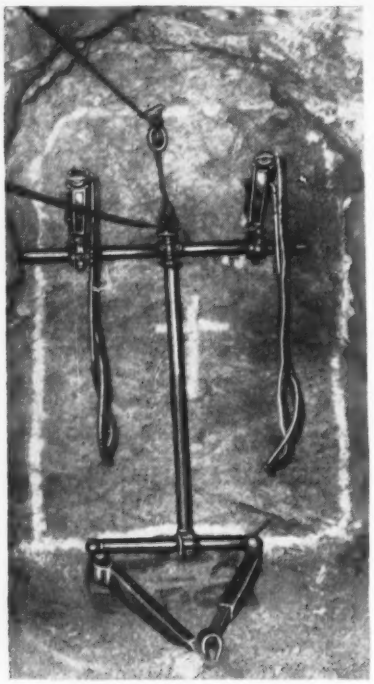
THE CHALLENGER DRILL has been developed for extra-heavy duty in taconite and other hard formations.

New Challenger for Drilling in Taconite

A NEW DRILL, known as the Challenger, has been developed by Joy Manufacturing Co. for drilling deep blast holes up to 5 in. in diameter and 50 ft. in depth in hard rock, such as granite, taconite and similar materials. The drill is an extra-heavy-duty percussion-type rock drill mounted on a mast in a self-propelled unit, as shown in the accompanying photograph. A dust collector is built into the new unit.

Mill Hole Construction Is Improved

TO PROVIDE MILL-HOLE structures underground that are better able to resist abrasion, Lamaque Gold Mines, Ltd., in Quebec, has substituted concrete for timber in both mill hole and chute. Chutes of individual design are built of concrete without reinforcement except for lining the chute bottom with 35-lb. rails turned flange up. Concrete for mill holes is poured in place in cut-and-fill stopes, without reinforcement, using prefabricated sectional forms. The cost of the chutes and mill-holes is approximately the same as for the timber structures. The concrete also wears longer and does not deteriorate. The mill holes will be used for permanent ventilation airways after the stopes are finished.



NEW JUMBO has been improvised by Climax Molybdenum Co. for use in slusher drift by mounting column and bar for two machines on crosspiece attached to folding scraper between bails, as shown. See also *EM&J*, Feb. 1953, p. 116.

Restoration of Land Winning Attention

RESTORATION by the mining company of the surface of mined-out land is receiving more and more attention in various areas. The pebble phosphate field in Florida and the phosphate area of central Tennessee provide interesting cases:

American Cyanamid Co., in Florida, is conducting an experiment at the Saddle Creek mine in the restoration of such land. The project covers 180 acres, approximately 150 of which has been leveled sufficiently to permit use of farm machinery. On this pangola grass and hairy indigo have been planted. This mixture has made sufficient growth to allow considerable grazing. The remainder of the tract is in lakes. As yet, the project has not progressed enough to permit definite conclusions; but at present it appears that this reclamation may be entirely sound economically.

Another Florida operator has a definite program for planting pines to restore the land after mining.

Much discussion has taken place between mining companies and farm organizations on releveling mined areas, according to Armour Fertilizer Works, Columbia, Tenn. The different problems involved have been presented to the farmers and public which seems to have reduced their hostility. Considerable releveling has been done, mostly by the land owners with some cooperation by the companies.

Survey Briefs

By using Sulmet carbide-tipped detachable, auger-drill bits, 1¾-in. diameter, for all drilling, Carey Salt Co., Hutchinson, Kans., has made such savings that it is economical to discontinue the high-carbon detachable coal auger bits they had been using, according to S. B. Horrell, vice president. With the new carbide bits they are getting about 200 holes between sharpening periods. These bits will usually stand 25 to 30 new sharpenings. The old detachable bits which have been discontinued could be used only for about 20 holes between sharpenings. They were limited also to a maximum of 10 sharpenings per set of bits. Bit cost per hole has been cut at least one-third by the change.

Half of its drilling is done with Throwaway bits, using I-R drills, and half with Coromant tipped steel, Atlas (RH656) and I-R machines (J50) and airlegs—this is Silbak Premier Mines' present practice in British Columbia, according to A. Kirby, Jr., mine superintendent. Detachable carbide bits are not now in use, but plans call for Carset bits with sectional steel for long holes. Use of airleg drills has boosted stope breakage 20%. In drifts the footage per day has increased at a lower contract price per foot.

Change from single-use bits to carbide-tipped forged steel with airlegs has been made at Combined Metals' Caselton mine.

In this mine, much of the stoping ground is supported with conventional roof bolts, and flat-lying ore beds are mined with open spans up to 50 ft. But in some of the ground, roof bolts will not anchor in the ravelly back, or the ground sloughs away between bolts. Modified methods with expansion bolts are to be tried.

Incline railway installations are planned for the Caselton mine to reduce preparatory work in waste required in mining flat-lying ore beds (8 deg. to 15 deg. stopes).

Detachable carbide bits (1½ in.), ⅞-in. hex. alloy rods, are now being used exclusively by Mountain Copper Co., California, according to C. W. McClung. The drills are I-R R38 and J50 machines, also the I-R Universal Jackdrill. This company formerly tried tipped steel made in its own shop.

Liddicoat single-pass bits, in use in medium ground by a Nevada operator, are replaced on the rod at surface, employing a pneumatic bit knocker. Detachable carbide bits (Timken) are used in hard ground, also on exploration holes 30 to 80 ft. long; sizes are 2 to 2¼ in. for normal drilling, 3½-in. for setting collar casing on grout holes.

A 300% increase in footage over diamond drills has been gained by this company in drilling holes up to 80 ft. long with Gardner-Denver 1-in. hex. coupled rods and G-D "O Ring 3" drifters on 4-ft. aluminum shells. The shank adapted has the G-D ring seal. Rods and couplings are a reverse buttress thread.

A program of backfill for current cut-and-fill stopes and for mined-out open and shrinkage stopes, using classified mill tailings placed hydraulically as fill material, has recently been started by Madsen Red Lake Gold Mines, in Ontario, according to E. G. Crayston, general manager. Tailings are classified in two stages by Dorr-Clones. The primary stage consists of two 12-in. DorrClones in parallel; the secondary stage is one single 12-in. DorrClone. The unit will treat approximately 325 dry tons of raw tailings (75% minus-200-mesh) per 24 hours and produce 175 dry tons of sands per 24 hours. The classified product is about 60% minus 200 mesh and has a percolation rate of between 5 in. and 7 in. per hour. It is sent underground to the stopes, through a 2½-in. borehole and steel pipe, as a pulp containing 57% solids. The discharge rate from the agitator storage tank to the mine is between 45 and 50 dry tons of sand per hour. To date a total of 23,000 tons has been placed in seven locations down to 1700 ft.

Trackless mining equipment is being tried on a limited basis by a company in the Pacific Northwest. It is too soon to cite benefits. The jumbo carriages are Rogers Iron Works and D4 Caterpillar respectively. Each jumbo has two Joy JB's and two Gardner-Denver 10-ft. change drifters. Loading equipment is a diesel-powered HD5G Allis-Chalmers unit with a 1-cu. yd. bucket. Haulage equipment consists of 6.3-cu. yd. Dart trucks.

More Airleg Drilling

SUMMARIZING CURRENT TRENDS in the drilling picture, G. B. Doner, drill sales manager for Chicago Pneumatic Tool Co., sees increases still under way in use of airlegs, of carbide bits including both detachable bits and tipped steel, and of long-hole percussion drilling. Some of the gain in the long-hole work has been at the expense of blasthole diamond drilling. Where drifters and carbide bits are used, the trend is still toward longer feed changes.

Jumbos are at least holding their ground. Even in small tunnels, or drifts, the jumbo and 3- or 3½-in. drifters are the answer where speed is wanted. Jumbos are undergoing refinements of control, with some trend toward self-propelled units.

For surface drilling of 4-in. and larger holes down to 100 ft. in depth, as Mr. Doner sees it, the rotary and percussion-type machines made gains, partly at the expense of wagon drills and well drills.

PROSPERITY IN THE USA: How Wealthy Are We?

Again, how prosperous *are* the people of the United States?

This is the third of a series of messages devoted to this crucially important and much-debated question. The first two messages dealt with what has been happening to our national income, both in terms of its growth and how it is divided among individuals.

This third message deals with what has been happening to the resources—factories, farms, mines, and equipment of all kinds—out of which income is created. It deals with what economists call our wealth.

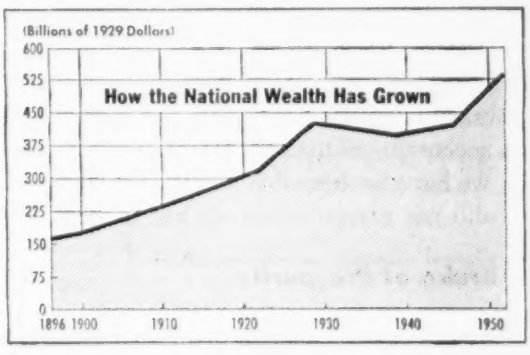
It is possible for a nation to enjoy apparent prosperity for a time by rapidly exhausting its resources. But to sustain prosperity over the long pull a nation must see that its wealth is not dissipated. Hence what is happening to our wealth now is a harbinger of what is going to happen to our prosperity later on.

How Wealth is Measured

It is often asserted that the most vital element in a nation's wealth is its people. There is a lot in this idea. For example, the full value of a country's hospital and surgical equipment depends on its physicians and their skill in handling the equipment.

However, no one has ever devised a satisfactory way to put a value on human beings. So people are omitted from calculations of national wealth. So, too, is military equipment. It is regarded as basically destructive and hence not a real addition to wealth. Otherwise, the wealth of a nation is calculated in terms of the dollar value of its physical resources.

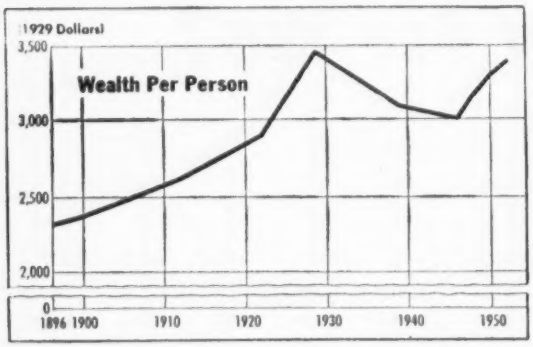
The following chart shows the wealth of the U.S.A. at various intervals during the past 50 years. For the period through 1948 the figures come from a pioneering study by Raymond Goldsmith of the National Bureau of Economic Research, which is widely regarded as the foremost organization in its field. The figures since 1948 are estimated. To remove the effect of price changes, all of the wealth figures are calculated in 1929 prices.



From this chart one fact stands out clearly. It is that since 1929 our national wealth has not been increasing as steadily as it did during

earlier periods. Indeed, in 1946 our total national wealth was actually less than it was in 1929. Only in the last six years have we been able to make any consistent additions.

Even these gains are less impressive when the growth in our population is taken into account, as illustrated by the following chart.



This chart makes it clear that when the nation's wealth is divided by the population, we are slightly worse off per person today than we were in 1929. This is the case in spite of the large additions to our national wealth since 1946.

Depression and war are the two principal reasons we have made no progress in increasing our wealth per person since the 1920s. The depression brought mass unemployment and greatly reduced production which ruled out any increase in wealth. During World War II and again during the post-Korean mobilization program, U.S. production has reached new peaks. But a considerable portion of this record breaking output has been in the form of military equipment, which is not included in an accounting of national wealth. Consequently, we have been unable to regain the level of wealth per person which we had in 1929.

A Brake of Prosperity

What does this failure to raise our wealth per person mean? It means that we have fewer resources with which to create income for each individual. It means that we have made no progress in the crucial task of assuring future increases in prosperity.

As the second editorial in this series demonstrated, we have gone so far in equalizing individual incomes that "the possibilities of increasing the income of the rest of the people by 'soaking the rich' have largely disappeared." From now on the only promising way to increase our individual incomes is to increase our national earning power.

During the past four years it has taken about $3.60 of national wealth to yield $1 of income after taxes. This is a low figure for the wealth needed. Prior to World War II there were long periods when it took at least $5 of national wealth to produce $1 of national income. The experts in this field are by no means certain that it will not again take $5 rather than $3.60 of wealth to increase income by $1.

But let us assume that $3.60 of wealth will suffice to provide $1 of income in the years ahead. If by 1960—seven years from now—the income of the average American is to be increased from about $1490, where it stands at present, to $2000, we must add $310 billion to the national wealth. This is nearly three times as much as we have added to our wealth since the end of World War II, seven years ago.

Because we have made large additions to our productive equipment in recent years, fears are frequently expressed that we shall soon be plagued by an excess of such equipment. But the facts about our national wealth do not support this conclusion. They indicate that we still have ahead of us a tremendous job of increasing our resources if the American standard of living is again to resume the steady climb which was interrupted by depression and war.

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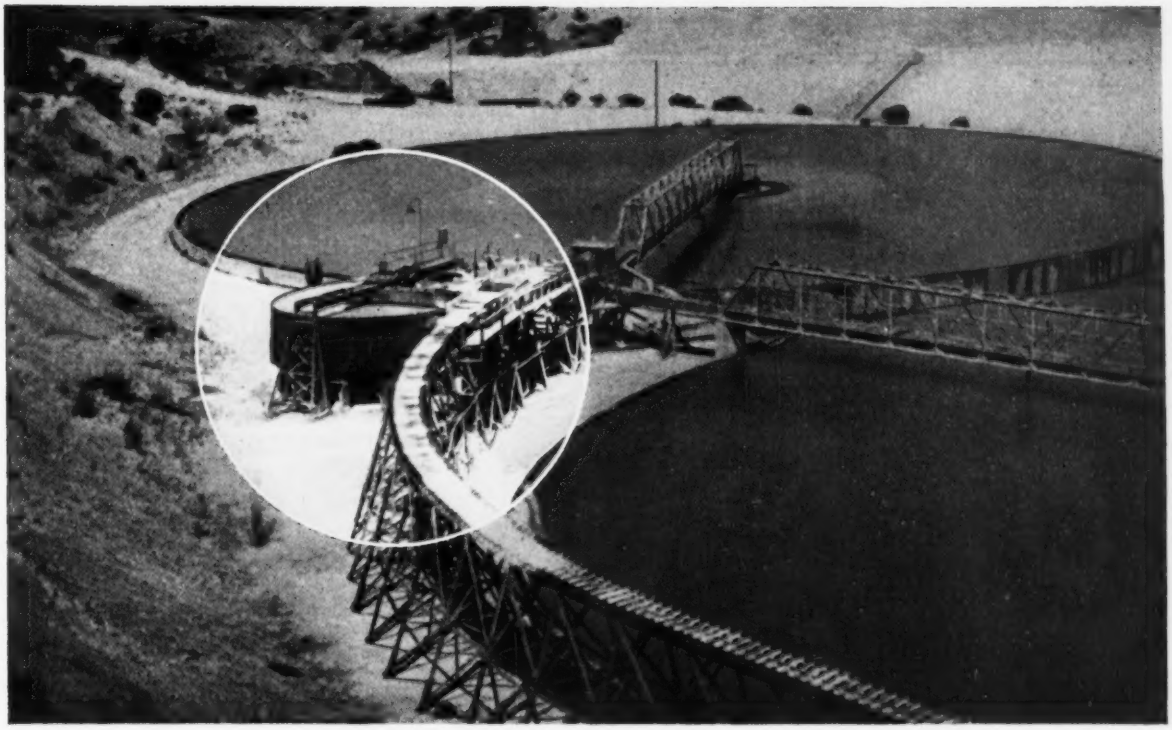

Smooth out your tailings operations

in spite of increased tonnage . . . changing ore characteristics

Here is how one operator solved the problem of increased tonnage and changing ore characteristics . . . with a Dorr Hydroseparator.

To handle a total of 12,000 tpd of copper flotation tailings at 26% solids, the initial installation included two Dorr Torq* Thickeners, each 225 ft. dia. When variables in ore characteristics reduced thickener capacity and increased water loss in the underflow, a Dorr Hydroseparator was installed ahead of the thickeners to compensate for shock loads. The Hydroseparator installation, resulting in better thickener performance, did two things:

1. Mill output *increased* by an average of 1,000 tons per working day.
2. The amount of water lost in thickener underflow *decreased* by 166 gpm.

The Summary of Operating Data shown here gives additional information, before and after the installation of the Dorr Hydroseparator.

To solve your tailings thickening problems, make use of our diversified experience in the field of metallurgical production. Let us know about your problems and we will work to solve them with you. THE DORR COMPANY, Barry Place, Stamford, Conn.

*Reg. U.S. Pat. Off.

Dorr Hydroseparator
Summary of Operating Data
Castle Dome Copper Co., Miami, Arizona

Year	Feed to System Avg. Tons Per Day	Character of Feed	Percent Solids Combined Underflow
	WITHOUT HYDROSEPARATOR		
1948 (Jan.-June)	10,406	Hard Ore	44.5
Dorr Hydroseparator Installed July 1948			
	WITH HYDROSEPARATOR		
1948 (Aug.-Dec.)	11,436	Hard Ore	45.2
1949	11,814	Variable Ore	46.4
1950	11,905	Variable Ore	47.8
1951	12,076	Variable Ore	47.9

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WASHINGTON IMPACT

Morton A. Reichek, McGraw-Hill Washington News Bureau

—Proposed Metals Credit Corp. Lacks Solid Support
—Blow for Paley Report Proponents in Postponed Conference
—Government Out of Aluminum Expansion

SEN. EDWIN C. JOHNSON'S BILL (S. 869) to set up a Metals Credit Corp. in the Interior Department to do the same sort of market stabilizing job for mining that the Agriculture Department's Commodity Credit Corp. has done so well for farming, has only a slim chance of getting through Congress. The obvious reason: the bill lacks solid mining industry support while the industry in turn lacks the kind of philosophical harmony that generally exemplifies agriculture.

Under the Johnson proposal, the marketing agency would deal in the strategic and critical metals and minerals covered by the Stockpiling Act. MCC would buy metals at not less than production costs from domestic producers, stockpile the materials, and then sell to industrial consumers at not less than the purchase price. It is not concisely clear what the relationship would be between the market support scheme and the Defense Department's strategic stockpile program.

The system in effect would be similar to the wartime Premium Price Plan—providing a guaranteed market for domestic output—but would be much more far-reaching in nature. In addition to direct purchase, MCC would be empowered to make loans on metals.

The Secretary of the Interior would be chairman of the corporation's board of directors. Other directors would be four Presidential appointees approved by the Senate. The President would also name an advisory board of five mining industry executives—not more than three from one political party—to keep tab on MCC's purchase, stockpile, and sales policies. MCC would have a capital stock of $100-million subscribed by the government.

Several influential government mining officials have already criticized Johnson's proposal. They contend that the program would be tough to administer because of difficulty in establishing average production costs. They say there is no adequate bench mark that could be applied.

Conceding that passage of the Johnson bill is doubtful, an official sympathetic to the program's objective, suggests that the proposal would find more general support if (1) tagged on as a national security provision to a defense mobilization bill, and (2) particular metals and prices were specified.

Sen. Johnson argues that his program would remove the need for protective tariffs on metals and would reduce foreign metal prices. Dependence on import taxes is no longer the answer to the mining industry's problems, according to the Senator. He considers creation of MCC an emergency measure that must be taken to preserve the U. S. mining industry. He points out that 73% of the mines in the 11 western states have been closed down in the last 10 years; 83% in his own state of Colorado.

Says the Senator: "We have neglected our mining industry while we have extended parity prices to our farmers; we have refused to extend parity prices to our mineral producers. The time has come to assure the mineral producer within the U. S. that he can sell at a profit, taking into consideration American standard costs of production."

Johnson is frank to admit that he is not optimistic about his bill's passage. He comments bitterly that he "isn't optimistic about anything for mining. The mining industry is always divided and never works together." He is particularly concerned about opposition to his bill by metals and minerals brokers.

The Johnson bill has been referred to the Senate Interior Committee. Sen. George Malone (Nev.), chairman of the Minerals Subcommittee, is reported to be vigorously opposed. An advocate of high tariffs on metals and minerals, Malone has looked distrustingly at mining incentives created by executive agencies of the government.

New Defense Legislation

The mining incentives contained in the present Defense Production Act (Title III Expansion of Productive Capacity and Supply) are contained in an omnibus Defense Mobilization bill introduced by Sen. Homer E. Capehart (Ind.), chairman of the Senate Banking Committee. This will probably be the basic mobilization legislation when the current law runs out June 30.

Primarily, the bill continues on a stand-by basis, until 90 days after the Korean war's end, the President's authority to establish priorities and make allocations, to requisition and condemn property, and to control prices, wages, rents, and credit.

Passage of the price-wage provisions is debatable, since President Eisenhower did not ask for the authority in his "State of the Union" message to Congress. He did ask for a simple priorities and allocations system on defense materials, and Capehart's bill would set this up.

The President did not specifically touch on defense production expansion, but both military and civilian mobilization officials are ardent proponents of the program. Here again, Capehart's bill would provide legislative authority. The President is empowered to (1) buy or make purchase commitments on metals, minerals, and other materials, and (2) encourage exploration, development, and mining of critical minerals. The existing incentive devices are provided.

Passage of this provision is almost assured. But its actual benefit to domestic mine operators may be slight. The authority is used to meet specific goals that the mobilization planners set up. Since most domestic metals expansion programs have already been completed, the goals would have to be substantially hiked if this is to be a boom to mining.

Resources Conference

Paley Report proponents have been dealt an indirect but damaging blow by the postponement of the much-publicized White House conference on natural resources policy, which was to be held March 25 in Washington. The conference was to be co-sponsored and conducted by Resources for the Future, Inc., a Ford Foundation-subsidized research organization, in which William S. Paley serves as a director.

According to RFTF's formal announcement, the conference was called as a big-time forum at which vital natural resources problems could be thrashed out by business, farm, labor, conservation, and government experts.

Many Washington observers, however, looked upon the conference as a glamorous sounding-board for the controversial Paley Commission recommendations. In particular, this was the feeling of the U. S. Chamber of Commerce's Natural Resources Department. The Chamber charged that the conference was to be run by New Dealers and "professional conservationists" on RFTF's staff, and that the conference agenda was stacked against the best interests of private industry.

(Continued on page 106)

Steel-Service Team

In there - - Pushing

Now more than ever the help of an experienced steel-service organization is especially valuable. That's why it may well pay to get in touch with the nearest Ryerson office or plant.

Not that we can *always* furnish the steel you need—much as we would like to, and hard as we try. But, with controls relaxing a little and a few steel products coming into better supply, there are more opportunities for experience and ingenuity to take over. And experience, ingenuity—and the will to help are never in short supply at Ryerson.

Your nearby Ryerson plant is staffed with specialists on carbon, alloy and stainless steels who are always ready to work with you. Often they can suggest practical alternates when the steel you need is not available. And back of the Ryerson plant nearest you stand the resources of fourteen other Ryerson plants, making up the nation's largest steel-service organization. So when a kind or size is not on hand locally, we may be able to ship it from another plant.

With all Ryerson plants cooperating, and with Ryerson specialists helping to make the most of available steel, we are usually able to maintain service in spite of the current situation. So we suggest that you check with us regularly for all your steel requirements . . . There is nothing too difficult when it comes to working with a Ryerson customer.

Principal Products: Carbon, Alloy & Stainless Steels — Bars, Structurals, Plates, Sheets, Tubing, Machinery & Tools, Etc.

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JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • PHILADELPHIA • CINCINNATI • CLEVELAND • DETROIT
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The White House got wind of the charges, and asked RFTF to call off the conference until late autumn. The postponement will give the White House a chance to iron out its own ideas on the Paley Report and other aspects of natural resources policy.

The postponement will also give RFTF a chance to reshuffle its staff and conference agenda on lines more friendly to business. First move was the ousting of Charles W. Eliot, a one-time New Deal planner, as the organization's executive director. Later this month, it will hold a preliminary planning meeting at which a broadly representative group—including people from the C. of C.—will begin work on new natural resources conference agenda.

The incident has been particularly embarrassing to Horace M. Albright, president of the U. S. Potash Co. He is in the anomalous spot of being both RFTF president and a member of C. of C.'s natural resources committee.

Aluminum Expansion

The government has stepped out of aluminum expansion—at least for the time being. Its aluminum expansion program was completed last month when the fourth new primary producer since Korea was lured into the business: Chattanooga's Wheland Co.; long-established producers of sawmill machinery, ordnance and oil drilling equipment, automotive parts, and grey-iron castings.

The program will boost domestic capacity from 719,000 tons annually in 1950 to at least 1,746,000 tons in 1955. The other post-Korea producers are Anaconda Copper, Olin Industries, and Harvey Machine Co.

Wheland was granted 85% accelerated tax amortization for construction of a $70-million primary aluminum plant in the Tennessee Valley with annual capacity of at least 50,000 tons. New York banking interests will reportedly finance the plant. When the financing arrangements are completed and Wheland has firm power and raw material commitments, DMPA will work out a five-year market guarantee pact with the company.

The government will guarantee purchase of any aluminum that Wheland cannot sell on the open market. Wheland will be paid a "weighted market price," which will be based on going Alcoa, Reynolds and Kaiser and on Wheland's share of the aluminum market. The government will have first call on two-thirds of Wheland's production. Wheland will make at least two-thirds of its output available to non-integrated aluminum consumers, to be deducted from the government's call.

Wheland claims to have firm TVA power commitments. Washington hears that the company is dickering with Reynolds Metals Co. for alumina supplies. Reynolds is already set to supply Anaconda's new aluminum plant at Kalispell, Mont.

LABOR THIS MONTH

Joseph M. Gambatese, McGraw-Hill Washington News Bureau

IMPACT OF WAGE DECONTROL: Wage trend is still upward. But wages won't rise any higher without controls than they would have if President Eisenhower hadn't suspended them on Feb. 6. That's the feeling in Washington. Wage regulations served as a floor instead of a ceiling. Those 134,000 applications handled by the Wage Stabilization Board were practically all above-ceiling propositions. Of them, 87% were approved in full, many of the others partially.

Union wage demands at this time lack steam. The cost-of-living index, heading downward, is below last June. The modernized index, with a 1947-49 base, will move more slowly than the prewar version. Unions are beginning to shy away from living-cost escalators. Instead, some favor frequent reopenings, every six months. New demands will be based on increased productivity and profits.

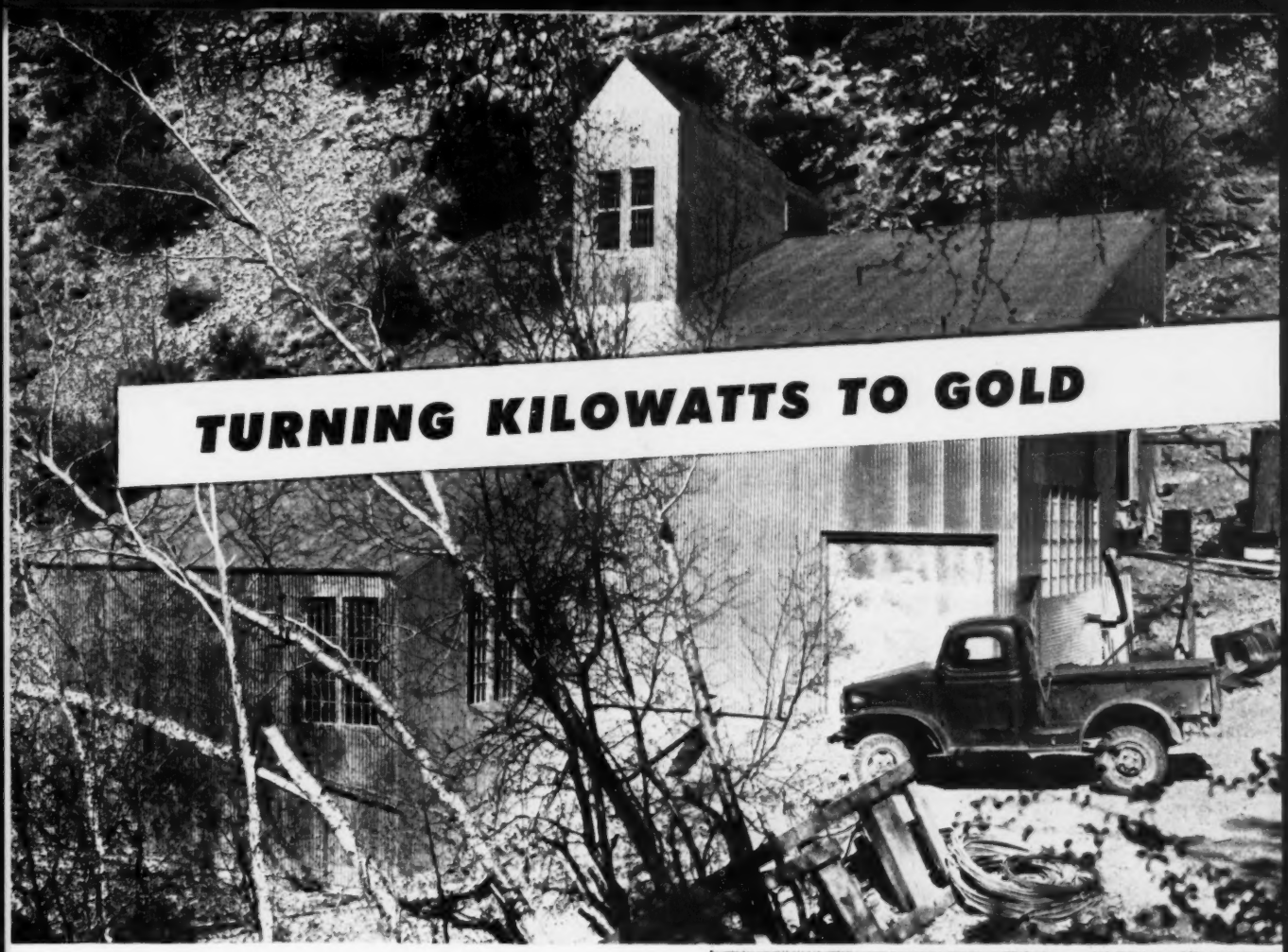
Current bargaining situations—automobiles, textiles, rubber, electrical and meatpacking—won't set any patterns. First big test will be in basic steel, where there is a July 1 wage reopening, followed by copper mining in August. Coal and railroads have an Oct. 1 deadline. Mine, Mill and Smelter Workers' demands will be discussed at Denver policy session late this month.

COPPER MINING RAISES TOTAL 81 CENTS POST-WAR: In justifying approval of an above-ceiling increase in shipbuilding, the Wage Stabilization Committee compared cumulative straight hourly increases in other industries since V-J Day. It showed increases in copper mining added up to 81.3¢ an hour—more than the 76¢ in rubber and electrical equipment, 77¢ in automobiles, meatpacking, shipbuilding and aluminum and 78¢ in basic steel. Industries with higher totals: railroads, 93¢; refineries, $1.06. WSC omitted coal mining's $1.01.

MINE-MILL HANGS ON AT COEUR d'ALENE: Mine-Mill is still a tough nut to crack out west. It suffered only small losses in fighting off raids by the CIO Steel Workers and AFL craft unions in the Coeur d'Alene (Idaho) mining district, where the mining union got its start 60 years ago. Mine-Mill retained bargaining rights at the larger Bunker Hill & Sullivan properties, the Sunshine operation and 24 smaller properties which bargain as one unit. It lost two small mines—Morning and Lucky Friday to the CIO, and bricklayers at Bunker Hill & Sullivan Mining and Concentrating Co. to the AFL.

MINE-MILL AFFIDAVITS QUESTIONED: Sen. Watkins, of the McCarran Internal Security Subcommittee, has asked the Justice Department to investigate the truth of non-Communist affidavits filed by three Mine-Mill officers—President John Clark, Vice President Orville Larson and Secretary-Treasurer Maurice E. Travis. Earlier, Watkins had asked the National Labor Relations Board to disqualify Mine-Mill unless its officers reaffirmed the truth of their affidavits. But a federal district court has enjoined NLRB from taking this step against three other left-wing unions. NLRB has appealed to the higher courts. Mine-Mill officers refused last October to tell the McCarran subcommittee whether their affidavits were truthful, although they have since submitted new affidavits as required by law.

OFF THE CUFF: Reports from Bayard, N. M., say Mine-Mill is making a movie based on the 15-month strike at Empire Zinc. Writers include some Hollywood scenarists who refused to tell Congressional committees whether they were Communists. Don't look for any revision of Taft-Hartley before its sixth birthday, June 27. Seems nobody is in any hurry to patch it up.



TURNING KILOWATTS TO GOLD

Gold is where you find it, and wherever you find it you need dependable power to mine it profitably. Eight thousand feet up in Nevada's Kingston Canyon, the Kingston Mine relies on a Caterpillar Diesel D364 Electric Set.

In this remote but important location, a 50-ton flotation mill, all electric motors and lights and a motor-driven air compressor are powered 24 hours a day, every day in the year, by a Cat Electric Set that is practically turning kilowatts into gold. Kingston Mine's Superintendent E. B. Crouch insisted on Caterpillar Diesel power for this job because of past experience with Caterpillar products.

The D364 puts out 165 KW for uninterrupted 12-hour duty. Its fuel system requires no adjustments and uses inexpensive, non-premium fuels without fouling.

There are 12 sizes of Diesel electric sets and your Caterpillar Dealer will be glad to explain and demonstrate their advantages for you. He's the man to see for service, too, and for those genuine Caterpillar parts which guarantee you the same Caterpillar quality that's built into every one of these Diesel engines and electric sets.

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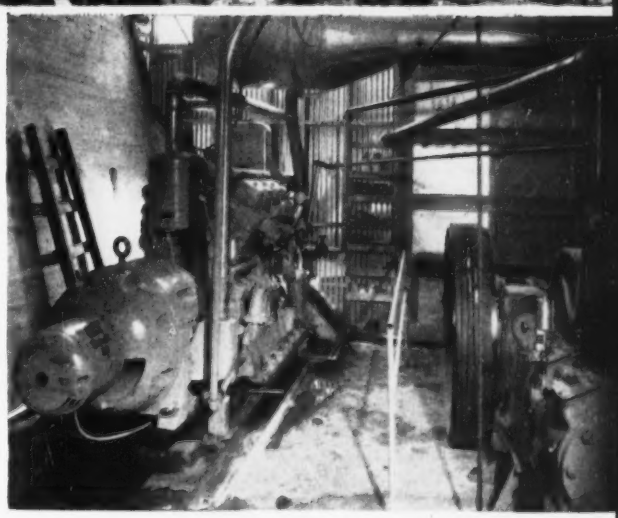

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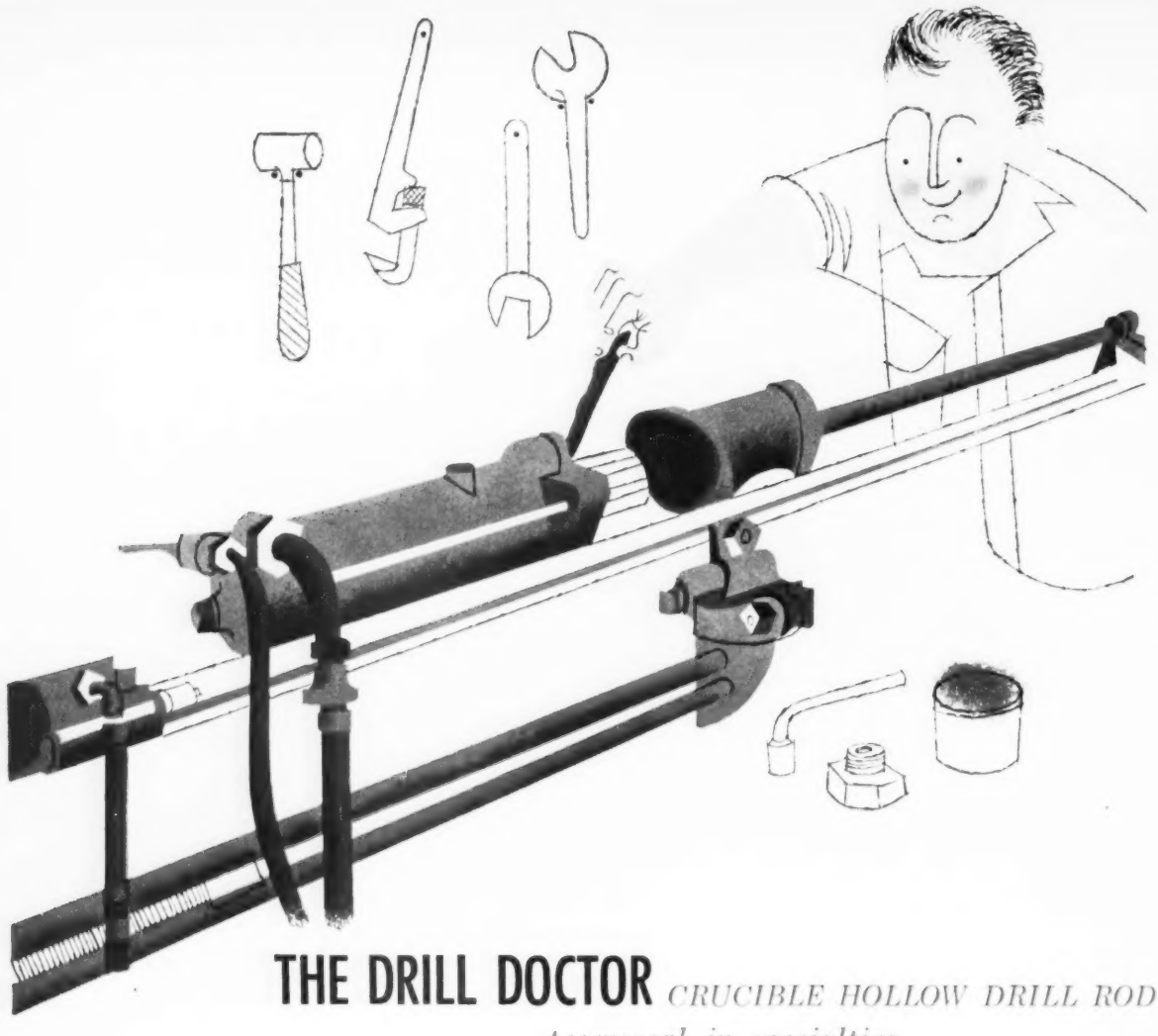
Electric Sets



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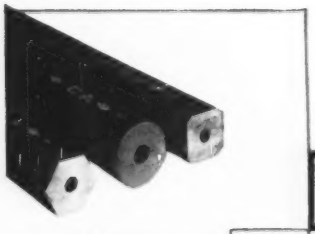
With the high cost of labor and new equipment he knows that to provide good service his drill must be made of the finest steels obtainable. That's why he counts on Crucible.

For Crucible Hollow Drill Rods have demonstrated time and time again their ability to take it . . . to withstand the severest punishment with minimum breakage and bit loss. And Crucible mills are among the few that produce steels that meet the rigid requirements of the rock drill piston — a part that undergoes the toughest service known for steel.

To get the lowest cost per foot per hole in rock drilling, specify Crucible Hollow Drill Rods.



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FEATURE

Supersonic Rock Crusher Demonstrated (1)

A PINT SIZED milling machine, using supersonic waves to pulverize minerals, was demonstrated in Reno, Nev., in January. Rock is fed into the machine by conveyor belt through a hopper on its side, and flies out instantly in the form of powder.

The machine—as yet unnamed—is probably the first ever built that is able to pulverize rock without using any form of impact. Its owner, Joseph Bassick, president of both Utilities Service Co. and Industrial Enterprises, isn't sure himself how it works other than it utilizes supersonic waves and tremendous air pressure.

The demonstration was witnessed by the U. S. Bureau of Mines officials, two representatives from the Coranda Corp., which is conducting exploration work for andalucite near Hawthorne, and a representative from the Alpine tungsten mine.

Bassick explained that the machine was developed in Boise, Idaho, but will be manufactured in Nevada, probably in Reno, soon. There are five models in existence, all being used on statistical tests at the present.

Mounted on a truck for the demonstration, the machine is powered by a V-8 engine which transmits its 60 hp. through two shafts to a pulley wheel.

Four rotor blades inside the machine spin at a terrific speed but never touch the rock, which is apparently kept from them by a cushion of swiftly moving air. At its full 5,000 rpm the blades force out 8,000 cfs.

Rocks feed into the machine by conveyor belt through a hopper on its side, flying out instantly in the form of powder.

In the demonstration, the powder was funneled into three hoppers, the first collecting comparatively coarse-ground material, the second dust that would pass through a 200 mesh screen and the third powder that was 400 mesh or finer. A return feed would channel coarser material back into the machine for further pulverizing in commercial operations.

Two types of minerals were used in the tests, tactite and andalucite.

The machine could eliminate the second and third stages of crushing in metal milling, although rocks fed into it must be first crushed to 2 in. in diameter or smaller. It can handle 10 lb. per minute or 600 lb. per hour, considerably speeding up present operations, but further research on Bassick's machine may be needed for milling metallic ores, however, because it presumably cannot be set to pulverize minerals to a pre-set screen size with the same tolerance a ball mill can.

In such an operation, however, the supersonic machine could effect sizeable savings over current grinding processes because none of the moving parts touch the ore.

INVENTOR JOSEPH BASSICK feeds rock into his supersonic mill. The unit has been tried on several nonmetallics and has good possibilities for metallic ore.

Robert Morris, whose Alpine mine conducts its milling operations near Gardnerville, noted that the present method of milling tactite ore costs $1 a ton in worn steel alone.

In the nonmetallic field the machine could probably be put into immediate use. One model has been experimentally operated for two years in Idaho grinding phosphate for fertilizer. It could also be used in pulverizing cement for limestone, and, according to Robert Holt, metallurgist and engineer for the Coranda Corp., might be put into use for making abrasives.

Speaking for the U. S. Bureau of Mines, A. C. Johnson, chief of the mining division, said his engineers were favorably impressed by the machine. He said it could be applicable in the nonmetallic field and, after further experimentation, might have wide applications in milling metallic minerals.

Bassick said the machine was developed about two and a half years ago and had been used in private demonstrations. He said, however, that he didn't feel it had been refined enough to place on the market until now. He holds the patents on the invention.

For further information on this supersonic mill, circle No. 1 on the postage-free card opposite page 110. Don't forget to include your name, title and address.

FORMULA FOR SUCCESS:

"Good operators and 'Caterpillar' equipment"

Rough-and-ready big yellow units and skilled operators. Omer Snyder, president of the Snyder Construction Co., Asbury, Mo., regards these as basic ingredients for success.

"I think 'Caterpillar' equipment is the best there is," he reports. "For hard rock and mud the D8 and No. 80 Scraper stand tough abuse, load large rocks, and dispose of them easily. I owe my success to good operators and 'Caterpillar' equipment."

Here's what convinced Mr. Snyder. In hauling overburden and ore from an open pit zinc and lead mine, his five D8s with Scrapers averaged 100 tons of ore an hour on an 800-foot haul. Shovel-loaded, they averaged 80 tons an hour. They carried a load of 15 pay yards per trip.

The D8s and Scrapers were doing what comes naturally. Being cable operated, the scraper can pump dead material. Its positive ejection gets rid of the load quickly and evenly. Loading and unloading fast . . . that's economy.

"Caterpillar" Diesel Tractors and Scrapers are built to last. And they'll stay that way if you insist on genuine "Caterpillar" parts and service. See your "Caterpillar" Dealer today.

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Equipment Shorts

HARDNESS CONVERSION TABLES. Celluloid card, wallet size, gives approximate relationship between Brinnell, DPH (Vickers), Rockwell and Shore Scleroscope hardness values and corresponding tensile strengths of steels. Data from SAE handbook. International Nickel Co., New York, N. Y. (31)

FLEXIBLE HOSE. Three new and improved types of "Flexaust," spiral wire reinforced flexible hose, are now available. Types CWL, CWC, and CWY are said to have greater resistance flexing fatigue and abrasion in handling air, gases or materials by pressure, suction or gravity flow. American Ventilating Hose Co., New York, N. Y. (32)

INDUSTRIAL HEATERS. For heating areas which cannot be heated by more conventional methods, self-contained industrial heaters ranging from 100,000 to 2,500,000-Btu. per hour in heating capacity, and from 2,000 to 25,000 cfm air velocity, are now available from Westinghouse Sturtevant Div., Boston, Mass. (33)

PLASTIC PIPE. U. S. Rubber Co., New York, N. Y., would like us to pass along the following information about Uscolite, their plastic pipe. It is a rigid, tough, strong, lightweight, corrosion resistant, thermoplastic pipe. It is available in both standard wall and extra heavy wall iron pipe sizes in an attractive medium gray color. It is easily cut and threaded in standard equipment and can be installed without special precautions. Uscolite pipe can be drilled and tapped, sawed and machined. (34)

BUCKET ELEVATOR. For loading feeder storage hoppers in tight spaces, Omega Machine Co., Providence, R. I., has designed model BES-77 elevator which houses its malleable iron buckets in a 9 x 24-in. steel casing. Boot, head and center section is fabricated of 12-gage steel and can be constructed to an overall height of 25 ft. Maximum delivery is 200 cu. ft. per hour. Each section has flanged ends and dust-tight joints. (35)

pH METER. This pH meter is ruggedly built for plant use for testing sample solutions or the contents of vats and tanks. Compact and portable, the Cambridge industrial model is all-electric; plug it into the nearest 110-v.a.c. outlet and it's ready for operation. Scale is graduated in 0.2 pH divisions and readings can easily be interpolated to 0.05 pH. Cambridge Instrument Co., Inc., New York, N. Y. (36)

CONVEYOR BELT FASTENER. A mechanic's hammer is all that is required to put in the "Turtle" conveyor belt fastener, offering a tight, quick and easy method of repairing and joining belts. These plates with three teeth on each side are available in steel, monel, stainless and everdur, from Flexible Steel Lacing Co., Chicago, Ill. (37)

TRIANGULATION TOWER. A lightweight, air-transportable triangulation tower which can be erected at heights varying from 37 to 103 ft. in less than one working day by an experienced five-man crew, has been developed by the Army's Engineer Research and Development Laboratories, Fort Belvoir, Va. (38)

CUTTING ELECTRODE. A Five-in-One cutting electrode cuts, chamfers, bevels, pierces and gouges. Needing no gases, it is convenient and according to the manufacturer, it works 2½ times faster than comparable electrodes at the same heats with only 2% more splatter. All-State Welding Alloys Co., Inc., White Plains, N. Y. (39)

GALVANIZED LOCKNUT. Security Locknut Corp., Melrose Park, Ill., has announced the development of a locknut that can be hot-dipped galvanized. Made in sizes from ⅝ in. to 1⅜ in., it will answer many problems where alkali, saltwater, or other corrosive elements play havoc with nuts and bolts. (40)

BULLDOZER. Following the development of the 9X, a "no pushbeam" bulldozer, Baker Mfg. Co., Springfield, Ill., announces the production of a bigger, more powerful dozer of similar design. In cooperation with Allis-Chalmers engineers, Baker has made the Hydraulic No-Pushbeam 96-in. wide bulldozer integral with the big HD-15 crawler tractor, and called it the Baker 15X. (41)

CONVEYOR WEIGHING SYSTEM. Development of a new conveyor belt weighing system capable of electronically adding, subtracting and recording tonnages delivered to one or more points, has been announced by Transweigh Co., Wayne, Pa., and Minneapolis-Honeywell Regulator Co., Philadelphia, Pa. (42)

FLOW METER. The Hays Diaflow meter is a low differential flow meter for measuring air flow, gas flow, or recording the ratio of air flow to gas flow. Hays Corp. Michigan City, Ind. (43)

RUBBER-TIRED TRACTOR. A four-wheel drive, rubber - tired tractor, Model TM "Payloader," is available with a 106-hp. gasoline engine or a 90-hp. diesel, weighs 25,000 lb., and develops up to 16,000 and 14,000 lb. drawbar pull. Uses torque converter drive in addition to a friction clutch and develops speeds up to 27 mph. Frank G. Hough Co., Libertyville, Ill. (44)

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For Your Files

This informative manufacturers' literature is free unless otherwise specified. To obtain bulletins circle their numbers on card below and mail.

JET PULVERIZERS. An eight-page folder giving the vital statistics on the jet pulverizer for fine grinding, fuel pulverizing, defiberization, drying and mixing, folds out to give a big, clear 20x14-in. cutaway view of the unit. Majac Engineering Co., Blawnox, Pa. (51)

BELT CONVEYOR CARRIERS. A remarkable amount of information on conveyor belt carriers available with drawings and photographs in the 20-page bulletin 2-C, issued by Stephens-Adamson Mfg. Co., Aurora, Ill. (52)

CONVEYOR NOMENCLATURE. To save time and money and to avoid confusion, "Conveyor Terms and Definitions" contains more than 1500 listings and the line drawings of more than 80 types of conveyors and parts. For major items, it includes terminology in French, German, Italian, and Spanish. The book is the product of 3 years' work on the part of Conveyor Equipment Mfrs. Assoc., Washington, D. C. (53)

PLANT MAINTENANCE. "Over the Rough Spots" tells how to patch holes or resurface any type of floor, simply and quickly; how to solve water seepage problems in underground foundations; how to repair roofs; how to preserve concrete and wood surfaces, and structural steel; plus a lot of handy hints on building maintenance problems. Stonhard Co., Philadelphia, Pa. (54)

FOUR-CYCLE ENGINES. Construction, operation and application features of 9-in. and 13-in. bore diesel, duafuel, and spark-fired gas engines, are contained in a new 12-page bulletin (205) published by Nordberg Mfg. Co., Milwaukee, Wisc. (55)

SPIRAL CONVEYORS. Full of useful information for deciding what kind and how big a spiral conveyor to use, Catalog 851 has tables, detail drawings and photographs. Jeffrey Mfg. Co., Columbus, Ohio. (56)

MINE LOCOMOTIVES. Here are 24 pages of description, specifications and illustrations of trolley, trolley and reel, storage battery, and combination trolley and storage battery metal mine locomotives made by Goodman Mfg. Co., Chicago, Ill. (57)

METALS. Chemical analyses of metals, alloys and ores, physical tests, corrosion studies, spectrographic analysis, and dozens of other services are priced in this four-page folder from Raymond C. Crippen Research and Development Laboratories, Baltimore, M. (58)

ANALYTICAL BALANCES. "Care and Use of Analytical Balances" gives information on how to choose proper location for balance, how to assemble and mount it, how to check sensitivity, and a discussion of weighing techniques. The 32-page booklet is offered by Torsion Balance Co., Clifton, N. J. (59)

MINING TOOLS. Latest information on when and how to sharpen tungsten carbide mining tools, equipment required, and best techniques to follow, is included in the new 26-page catalog and maintenance manual CM-110 just made available by Carboloy Department of General Electric Co. (60)

SURVEYING INSTRUMENTS. Engineers concerned with surveying will be interested in sending for a series of well illustrated catalogs from Wild Heerbrugg, Switzerland, telling about their Pocket, Double Center and Universal Theodolites. There is also a complete products list and a bulletin with technical data on less precise surveying instruments. (61)

WIRE ROPE. This 64-page handbook contains more than 100 illustrations on various types of wire rope slings. Charts show correct calculations for determining sling sizes and correct sling angles in relation to loads. A. Leschen & Sons Rope Co., St. Louis, Mo. (62)

PINCH VALVES. Farris Flexible Valve Corp., Palisades Park, N. J., offers a 24-page catalog telling you why, how and which flexible pinch type valves to use. Contains engineering data on flow characteristics, diaphragm operation pressures, etc. There are corrosion and abrasion recommendations and mounting and installation information with capacities. (63)

ROTARY PUMPS. Covering both the herringbone gear type, with capacities to 5,000 gpm.; pressures to 100 psi.; and the sliding vane type, with capacities to 1,000 gpm., pressures to 200 psi., Bulletin W-483-B2 from Worthington Corp., Harrison, N. J., is complete with fields of application, coverage charts, mountings, dimensions, and other engineering data. (64)

POWER DISTRIBUTION. Here's a good 28-page illustrated booklet, "Industrial Power Distribution Idea Book," that should find a place in the files of electrical engineers in the big mines and any engineer or operator in a small property. It covers utility distribution practices; methods of buying electric power; what to do when a choice of primary voltages is available; application of primary switches and circuit breakers; types and arrangements of primary cables; and types of load-center distribution systems. General Electric Co., Schenectady, N. Y. (65)

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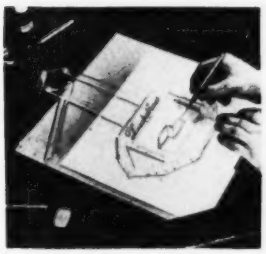
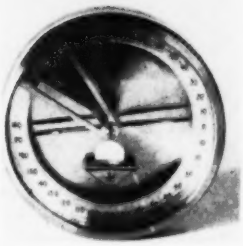
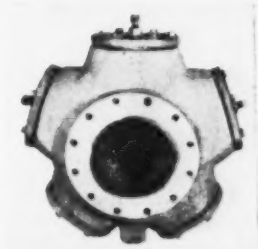


DRAWING INSTRUMENT enables even amateur draftsmen to make quick accurate drawings. It consists of a transparent plastic template cut to accurate angles, calibrated in inches and millimeters. Can draw circles, parallel lines. F. & D. Brownlie, London. (2)

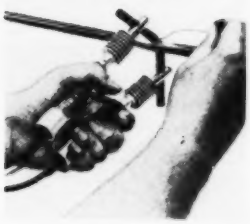
THERMOBOOT keeps feet warm with one pair of medium weight socks, offers absolute protection against frostbite. Three types, for 10° below to 60° above; for 40° below to 60° above; and hip length waders, come in sizes 5 to 14. Techno Efficiency Council. (3)



DIP NEEDLE is a non-electronic, magnetic, self orientating instrument for defining areas of high magnetic characteristics, designed for fast traversing where disturbing factors are not suspected to be too great. Radiac Co., New York, N. Y. (4)

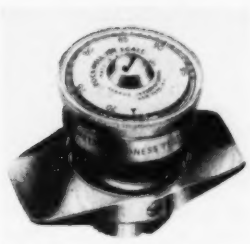


CHECK VALVE for compressor discharge lines, available in 8, 10, and 12-in. sizes, effectively dampens pulsations. Four 12-in. Airchek valves like this have been installed for U. S. Smelting, Refining & Mining Co. Pennsylvania Pump & Compressor Co. (5)

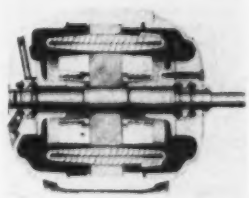


PLIERS HANDPIECE eliminates the need for a separate ground connection to an article to be soldered and is a convenient accessory for the Wasserlein Mfg. Co.'s (Joliet, Ill.) "Glo-Melt" resistance soldering unit. Functions on tubing up to ⅝ in. O. D. (6)

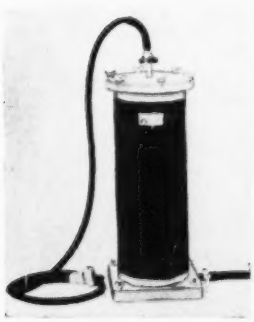
"SONIC EAR-VALV" protects the ear by acting as a protective ear drum, shutting out loud noises but allowing the ear canal to remain open for hearing voice level sounds. New Silicone rubber tip makes it more comfortable to wear. Sigma Engineering Co. (7)



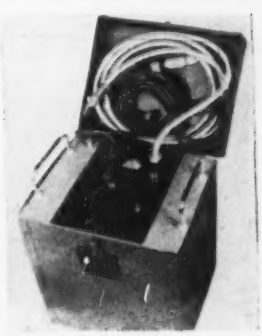
PORTABLE HARDNESS TESTER makes possible on-the-job metal hardness testing without damaging the material or part. You simply place tester on material and press downward on the handgrips to obtain a direct reading. Newage International Inc. (8)



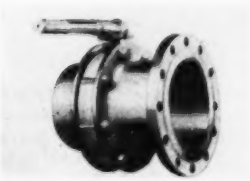
TOTALLY ENCLOSED MOTOR is designed for services where dampness, dust, fire hazards and corrosive fumes exist. Designated as Type SS, it is self-cooling. Available from ⅓ to 2 hp. Will be produced in larger ratings later. U. S. Electrical Motors, Inc. (9)



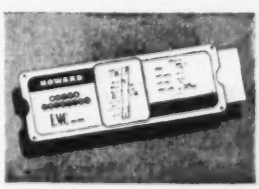
ION-EXCHANGE REACTOR is described as a liquid conditioning machine servicing the entire field of ion exchange, plus the removal of solid and gaseous media. It is designed to be used individually or in multiples for simple or complex ion exchange processes. It can be used as a pilot model or low cost water demineralizer. Enley Products Inc. (10)



FAULTFINDER locates faults in cables quickly and prooftests to locate incipient faults. A noise like a pistol shot is produced at the fault at 1 to 3 second intervals. With the impulse applied to the cable, now disconnected from the system, the operator follows the cable to the noise. No instruments, no calculations. Electrical Distributors Co. (11)

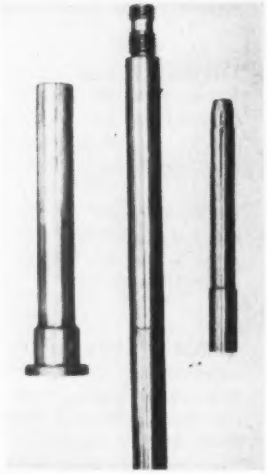


BUTTERFLY VALVE features speed and ease of operation plus a design that permits use of any combination of interchangeable end connections. Keystone Tool Corp. (12)

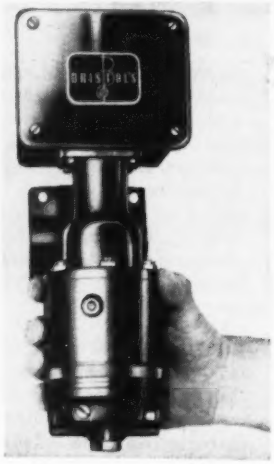


MOTOR SELECTOR provides detailed information on 35 fractional motors in ratings from 1/2000 to ½ hp. so that user can select motor at a glance. Howard Industries, Inc. (13)

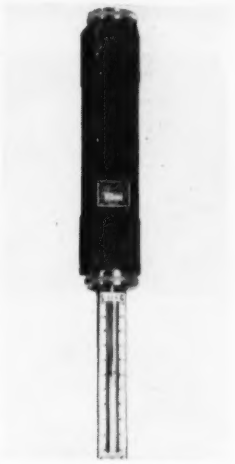
SURFACE PYROMETER offers selection of 14 different types of thermocouples and extension arms for every surface and sub-surface temperature problem. Pyrometer Instrument Co. (14)



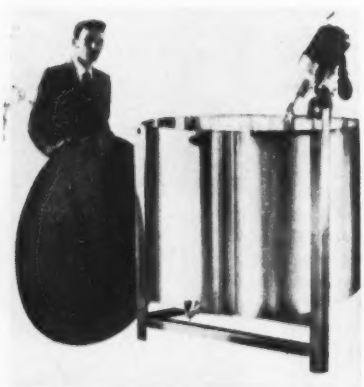
FLAME-PLATING is a method for applying hard, thin, coatings of powdered metals like tungsten carbide on metal parts to prevent wear. Linde Air Products Co., New York, N. Y. (15)



MINIATURE PNEUMATIC TRANSMITTER measures, transmits temperature, pressure, vacuum, liquid level readings to recording and controlling receivers. Bristol Co. (16)



FLOWMETERS for air and industrial gases comes in 11 sizes, each with built-in calibration for specific gas. Waukee Engineering Co. (17)

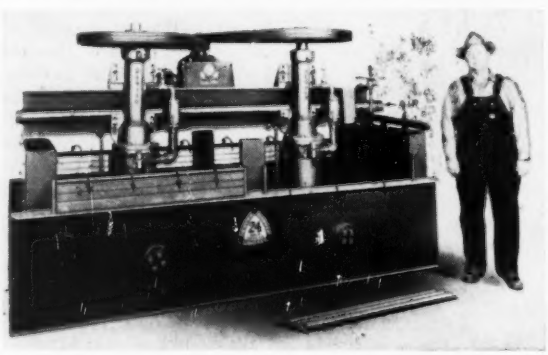


MIXING TANKS feature inverted air seal cover of transparent, inert resin, which floats atop contents. Spin of the cover sends trapped air bubbles to edge. Reco Sales Co. (18)

VINYLITE TARPAULINS to protect your equipment are waterproof, peelproof, crackproof, resistant to abrasion, oils. Cost half as much as duck. American Agency, New York. (19)

CHAIN SAW sells for only $99.50 but manufacturer claims it has enough power and speed to handle toughest woodcutting jobs. Needs only one man. Porter-Cable Machine Co. (20)

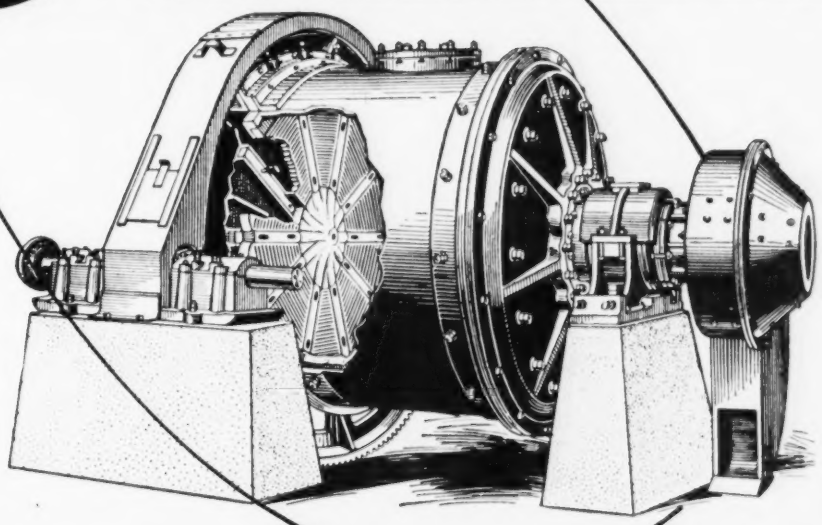
DROP BOTTOM CARS built for U. S. Potash Co. by Sanford-Day Iron Works have a full level capacity of 205 cu- ft., are 16½ ft. long and 48 in. high. Doors are overlapping type, sealed against dust leakage. (21)



FLOTATION MACHINE is Denver Equipment Co.'s Super Rougher. Features low level froth overflow, two impellers on each shaft, and open tank for pulp flow and super aeration. Two-cell "Sub-A" weighs 4900 lb. (22)

Worldwide Proof

# of MARCY MILLS' low cost performance



● Grinding mills are selected on the basis of low cost per ton output and efficient, dependable mechanical operation. That's why so many successful mining companies throughout the world use Marcy Mills. In addition to the many Marcy Mills chosen by both large and small U. S. companies, Marcy Mills have recently been the choice of leading companies (many repeat orders) in the following countries..

CANADA	BOLIVIA	BELGIUM	ENGLAND	NEWFOUNDLAND
CHILE	MEXICO	YUGOSLAVIA	COLOMBIA	BELGIAN CONGO
PHILIPPINES	IRELAND	NEW ZEALAND	PERU	KENYA, E. AFRICA
ITALY	MOROCCO	GREECE	FRANCE	KUWAIT
AUSTRALIA	SO. RHODESIA	NOVA SCOTIA	AUSTRIA	

● Marcy Mills have also been sent to...

JAPAN	BRAZIL	PORTUGAL	KOREA	HONDURAS
ALASKA	EL SALVADOR ECQUADOR	SWEDEN	RHODESIA	INDIA
CUBA	VENEZUELA	ARGENTINA	NEW CALEDONIA	
CHINA	FINLAND	TURKEY	FIJI ISLANDS	

Get the ***facts***, actual operating data, on low cost per ton Marcy Mill performance from our grinding specialists.

The Mine & Smelter Supply Co.

DENVER 17, COLORADO

OFFICES IN SALT LAKE CITY, EL PASO, 1745 BROADWAY, N. Y. C.

REPRESENTATIVES IN FOREIGN COUNTRIES

MARKETS—Trends and Prices (*Continued from page 69*)

U. S. Mine Production of Copper

(Bureau of Mines)

Production of copper at mines in the United States declined slightly in 1952. One reason for the failure to better the 1951 record was that the grade of ore at some important mines declined. Mine production of copper in the last five years, by states, in tons:

States East of the Mississippi:	1948	1949	1950	1951	(a)195
Michigan	27,777	19,506	25,608	24,979	21,812
Other	14,248	13,449	14,497	16,140	14,946
	42,025	32,955	40,105	41,119	36,758
Missouri	2,370	3,670	2,982	2,422	1,726
Western States:					
Arizona	375,121	359,010	403,301	415,870	393,350
California	481	649	646	921	820
Colorado	2,298	2,403	3,141	3,212	3,388
Idaho	1,624	1,438	2,107	2,160	3,023
Montana	58,252	56,611	54,478	57,406	63,320
Nevada	45,242	38,058	52,569	56,474	57,040
New Mexico	74,687	55,388	66,300	73,558	77,000
Oregon	2	20	19	11	1
Texas	23	24	2	1	18
Utah	227,007	197,245	278,630	271,086	283,500
Washington	5,665	5,275	5,057	4,089	4,525
	790,402	716,121	866,250	884,788	885,985
Alaska	16	4	6	1	...
Totals	834,813	752,750	909,343	928,330	924,469

(a) Preliminary figures.

Copper Statistics

The copper statistics of Copper Institute for January revealed that production of crude, here and abroad, declined moderately. Shipments remained relatively high. The figures for December and January, in tons:

UNITED STATES

	(a)Dec.	Jan.
Production:	1952	1953
Crude, primary	81,250	77,783
Crude, secondary	3,989	2,797
	85,239	80,580
Refined copper	113,965	108,010
Deliveries, refined (b)	143,088	125,133
Stocks, refined (c)	58,858	59,836

OUTSIDE UNITED STATES

	Dec.	Jan.
Production:	1952	1953
Crude, primary	123,794	120,015
Crude, secondary	1,769	2,119
	125,563	122,134
Refined copper	100,374	93,667
Deliveries, refined	84,216	81,417
Stocks, refined	130,103	120,629

(a) Corrected figures. (b) Includes tonnages delivered from Government stocks and imports of foreign copper for account of other than members of Copper Institute. (c) Includes tonnages delivered to U. S. at foreign ports.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments f.o.b. New York unless otherwise stated

MISCELLANEOUS METALS

February 28, 1953

Aluminum ingot, 99 plus percent, lb. (effective Jan. 22)	20½c.
Antimony, spot, lb., 5 tons and up but less than carload, in cases	37.97c.
Bismuth, ton lots, lb	$2.25
Cadmium, commercial sticks, delivered, lb	$2.00
Calcium, lb., ton lots, 98 percent, cast	$2.05
Chromium, 97 percent grade, lb., contract	$1.18
Cobalt, 97 to 99 percent, per lb.	$2.40
Germanium, lb.	$340.00
Indium, troy oz.	$2.25
Lithium, lb., 98 percent	$11.00 @ $14.00
Nickel, cathodes, lb., f.o.b. Port Colborne (a)	60c.
Magnesium, 99.8 percent, carloads, lb., producer's plant, Freeport, Texas	24½c.
Palladium, troy oz.	$24.00
Platinum (Official quotation wholesale lots) troy oz.	$90.00
Quicksilver, flask of 76 lbs., 25 flasks or more	$202 @ $205
Selenium, 99.5 percent, lb.	$3.00 @ $3.50
Silicon, minimum 97 percent, carloads, lb.	20c.
Tellurium, lb.	$1.75
Thallium, 100 lb. or more, lb.	$12.50
Titanium, 99.3 percent, lb.	$5.00

(a) Includes U. S. duty.

METALLIC ORES

Beryllium Ore, Imported, 10% BeO, per unit	$46.00 @ $48.00
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry	
44% Cr_2O_3 no ratio	$27.00 @ $32.00
48% Cr_2O_3 3 to 1 ratio	$44.00 @ $56.00
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$9.45
Mesabi bessemer	$9.20
Mesabi, non-bessemer	$9.05
Lead (Galena), 80 percent, Joplin, Mo., ton	$166.50
Manganese Ore—Per long ton unit of Mn basis 48 percent manganese, nearby positions, subject to premiums and penalties, $1.18 @ $1.21 c.i.f. U.S. ports, duty extra. Long-term contract nominal at 90c. to 93c., c.i.f. duty extra.	
Molybdenum Ore, 90%, per lb. of MoS_2 f.o.b. mines	60c.
Tantalite, 60% concentrate, per lb.	$2.50 @ $3.00
Tungsten Ore, per unit of WO_3	
Foreign, 60 percent, f.o.b. foreign ports	$40.00 @ $41.00
Domestic, scheelite, 60 percent f.o.b. mill	$63.00 @ 65.00
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines	31c.
Zinc Ore, Prime, 60 percent concentrate, Joplin, Mo., per ton	$70.00

(a) F.o.b. port of shipment.

METALLIC COMPOUNDS

Arsenous Oxide (arsenic trioxide) lb., in bbl. carload lots delivered	5½c.
Cobalt Oxide, 72⅓ to 73⅓%, ceramic grade, per lb.	$1.82 @ $1.84½
Copper Sulphate, 100 lb.	$8.95 @ $9.95
Germanium Oxide, lb.	$142.00

ALLOYS

Beryllium Copper, 4 percent Be, per lb. of alloy, 5 lb. ingot	$1.80
Ferrochrome, 65 to 69 percent, per lb. of Cr contained	24⅜c.
Ferromanganese, 78 to 82 percent, gross ton, seaboard	$225
Ferromolybdenum, 55 to 65 percent Mo. lb. of Mo. contained	$1.32
Ferrosilicon, 50 percent, per lb. of contained Si	12.4c.
Ferrotungsten, 75 to 80 percent, lb. of W contained	$4.85
Ferrovanadium, per lb. of V delivered	$3.00 @ $3.25
Silicomanganese, Max. 1½ percent carbon, per lb. contracts	11.4c.
Spiegeleisen, per long ton, 19 @ 21 percent grade	$85.00

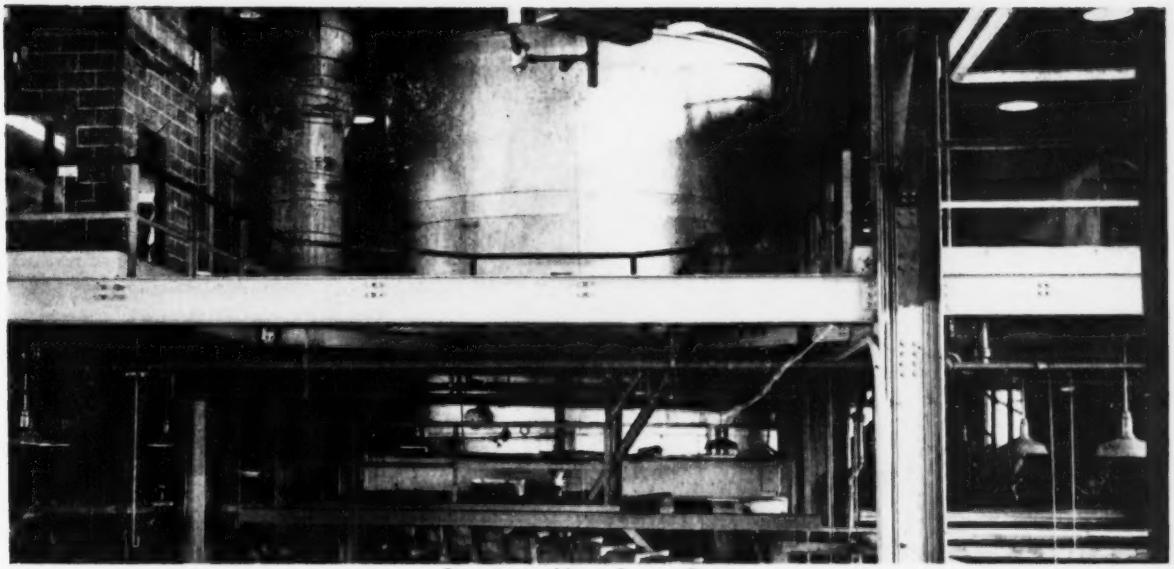
NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (U. S. funds) ton:	
Crude No. 1	$960 @ $1,500
Crude No. 2	$595 @ $900
Spinning fibers	$321 @ $514
Shingle fibers	$150 @ $200
Paper stock	$109 @ $137
Waste	$77
Shorts	$35 @ $70
Asbestos, Vermont, f.o.b. Hyde Park:	
Spinning fibers	$279.50 @ $302.00
Shingle stock	$135.00 @ $162.00
Paper stock	$81.50 @ $115.00
Waste, stucco or plaster	$71.40
Refuse or Shorts	$34.00 @ $63.00
Barytes, f.o.b. mines:	
Georgia, crude, per long ton	$13.00 @ $13.50
Missouri, 93 to 94 percent $BaSO_4$, per short ton	$10.15 @ $10.40
Bauxite, long ton, f.o.b. point of shipment:	
Domestic, crude, 50 to 52 percent (not dried)	(a) $5.00 @ $5.50
Domestic, chemical, 55 to 58 percent	(a) $8.50 @ $9.50
Domestic, abrasive, 80 to 84 percent	(a) $18.00 @ $18.50
China Clay, f.o.b. mines, ton:	
Georgia, filler and ceramic grades	$8.50 @ $9.50
North Carolina ceramic grade	$20.25 @ $22.25
Feldspar, bulk ton:	
Potash or soda feldspar, 200 mesh, ceramic grade	$18.50 @ $22.25
Glass feldspar, white, 20 mesh	$11.75 @ $12.50
Fluorspar, f.o.b. mines, bulk, 70% effective ton	$43.00
60% effective CaF_2	$40.00
Acid 97% concentrate, bulk, ton	$60.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00 @ $14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington	$39.56
Mica—Domestic, f.o.b. mines. Punch 12 to 22c. per lb. according to size and quality. Sheet clear, 1½ x 2 inch, 80 to 85c.; 2 x 2 inch, $1.10 to $1.20; 2 x 3 inch, $1.50 @ $1.60; 3 x 3 inch, $1.80 @ $1.90; 3 x 4 inch, $2.20; 3 x 5 inch, $2.40; 4 x 6 inch, $3.15; 6 x 8 inch, $4.25. Wet, ground, very fine, $140 @ $155 per ton. Bulk sales, dry ground: $32.50 @ $70.00 per ton Scrap $32 and up.	
Ocher, Georgia, ton, in sacks	$26.25
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	Not quoted
Sulphur, Texas, mines, long ton	$22.00
Talc, f.o.b. works, ton:	
New York, purified	$18.50 @ $20.00
Vermont, extra white	$12.50
Tripoli, Missouri, ton:	
40 mesh, cream colored	$30.00

(a) Nominal.

IRON AND STEEL

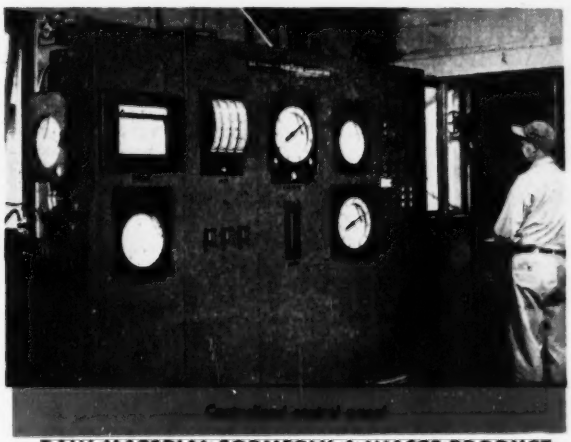
Pig iron, gross ton, basic, Valley furnaces	$54.50
Steel, f.o.b., Pittsburgh billets, net ton	$59.00
Structural shapes, 100 lb.	$3.85



General view of Brown Company Reactor

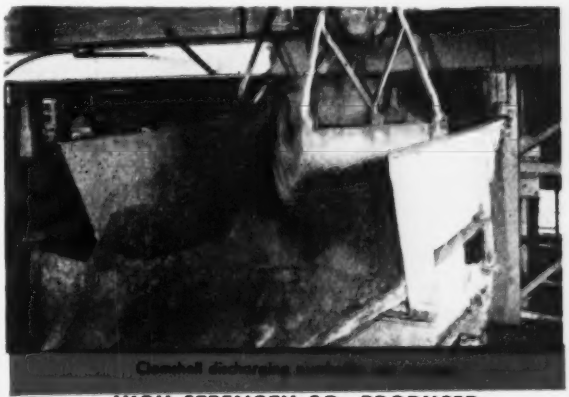
First Dorrco FluoSolids* Reactor For Producing SO_2 Goes "On Stream" at Brown Company

BERLIN, N. H. In anticipation of a continuing sulfur shortage, The Brown Company at Berlin, N. H. recently installed a Dorrco FluoSolids System to produce SO_2 gas from pyrrhotite. The System at the present time is supplying the entire sulfur requirements of this sulfite pulp mill . . . 11,000 tons of sulfur equivalent per year. A producer of quality pulp for high-grade photographic papers, Brown requires clean, high-strength SO_2 gas to make their sodium sulfite cooking liquor.



RAW MATERIAL FORMERLY A WASTE PRODUCT

The pyrrhotite, recovered from tailings of a nearby copper mine, is received in a moist condition, repulped with water to 70-75% solids, and pumped into the Reactor. By operating close to theoretical oxygen requirements, the strongest possible SO_2 gas is produced, with a black magnetite calcine which is quenched and handled in slurry form. Roast is accomplished in a 16' inside diameter Reactor with the temperature automatically held at 1650°F.



HIGH STRENGTH SO_2 PRODUCED

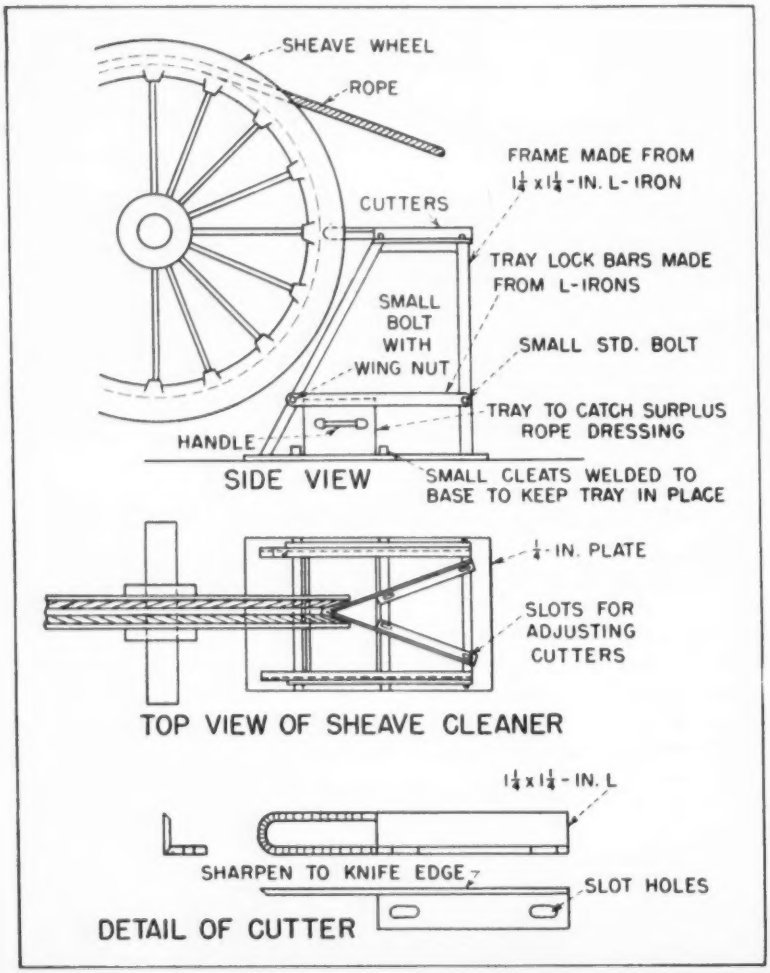
Gas strength at the top of the Reactor averages 13% SO_2. The gas then passes through a two-stage cyclone system followed by a cooling-scrubbing tower before going to the acid towers. Average chemical analysis of feed and calcine follows:

	Total Sulfur	Sulfide Sulfur	Total Fe
Pyrrhotite Feed	35.7	35.6	49.1
Combined Calcine	0.51	0.49	60.9

For detailed information about FluoSolids — a distinct departure from conventional roasters — write for Bulletin No. 7500. The Dorr Company, Stamford, Conn. or in Canada, The Dorr Company, 26 St. Clair Avenue East, Toronto 5.

* Trademark Reg. U. S. Pat. Off.

OPERATING IDEAS


SHEAVE WHEEL
ROPE
FRAME MADE FROM 1¼ x 1¼ - IN. L - IRON
CUTTERS
TRAY LOCK BARS MADE FROM L-IRONS
SMALL BOLT WITH WING NUT
SMALL STD. BOLT
TRAY TO CATCH SURPLUS ROPE DRESSING
HANDLE
SIDE VIEW
SMALL CLEATS WELDED TO BASE TO KEEP TRAY IN PLACE
¼ - IN. PLATE
SLOTS FOR ADJUSTING CUTTERS
TOP VIEW OF SHEAVE CLEANER
1¼ x 1¼ - IN. L
SHARPEN TO KNIFE EDGE
SLOT HOLES
DETAIL OF CUTTER

Sheave Cleaner

PHIL KEAST, master mechanic, Empire Star Mines Co., Ltd., Grass Valley, Calif., suggests the simple device shown for removing excess grease or rope dressing from head sheaves. It has given satisfactory service on several hoisting installations for more than two years. Principal benefits obtained through its use are: (1) sheave grooves are kept clean at all times, and (2) no rope dressing can fall onto the headframe or into the ore bins.

The device is of simple design and can be made at any mine machine shop at low cost. The frame holding the cutters, made from light angle iron, all welded, is bolted to the stringers supporting the sheaves. Cutters used are also made from angle iron as shown. They have slot holes to permit easy and quick adjustment. When in proper position, the cutting edges are about ⅛ in. away from the sides of the sheave rims, and the centers of cutters set on sheave center line. Scraped-off material falls into a metal tray or box installed below the cutters. Two small cleats welded to the frame base plate keep the tray in line and two pivoted angle irons keep it securely in place so it cannot get caught in the sheave in the event rope dressing builds up beyond normal level. Small bolts with wing nuts are used to lock the free ends of the tray lock bars.

Visual Drill Log Better than Words

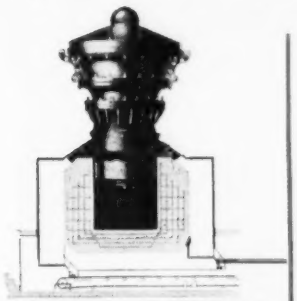
WHY WASTE TIME with a lot of words to describe the sequence of samples taken from a drill hole, when you can mount the actual rock samples on boards such as those shown here? This system of visual logging is in use at the Caselton operations of Combined Metals Reduction Co., 9 mi. west of Pioche, Nev. Rock particles for 5-ft. sections are mounted in sequence on the boards.

Shown at left are S. S. Arentz, general superintendent, and E. S. McIntire, engineer.

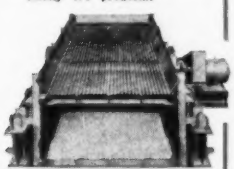
KENNEDY

CRUSHING MACHINERY and EQUIPMENT, COMPLETE MINING PLANTS

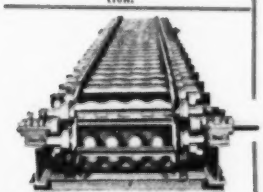
. . . . in use the world over!



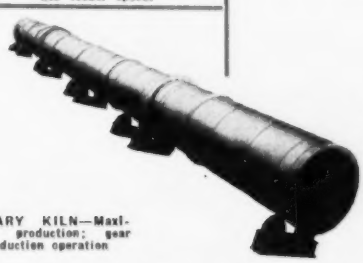
GYRATORY CRUSHER—70 degree double discharge outlets solve sticky ore problem.



VIBRATING SCREEN—1, 2, 3 decks; 4-way, variable-speed vibration.



ROCK FEEDER—Up to 20'/minute feeder speed.

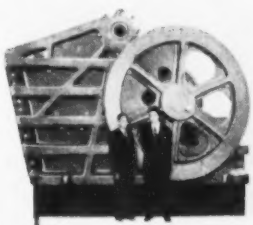


ROTARY KILN—Maximum production; gear reduction operation

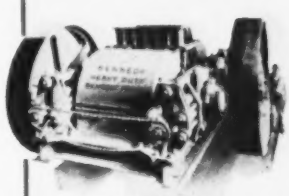
KVS machinery and equipment is designed, engineered and built to serve the aggregate and mining industry. Scientific, physical aids that combine utmost utility with rugged stamina . . . the kind of machinery that produces peak capacities with a minimum of maintenance.

An outstanding characteristic of KVS equipment is the fact that all parts are standardized . . . replacement can be made by any qualified machinist . . . spare parts FIT, because they are machined to exacting tolerances . . . ready for instant use. When the rare occasion arises where replacements are necessary, air express deliveries bring you the part needed anywhere in the world and the machine is back in operation within a matter of hours!

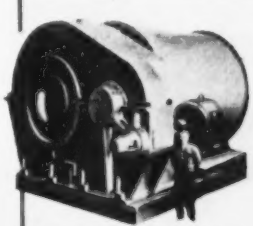
Enthusiastic users tell us that KVS machinery is breaking all records for producing maximum rock tonnage at minimum operating cost. Our engineers are available at any time for consultation on *your* crushing and handling problems. Write, cable or phone.



SWING JAW CRUSHER—Heavy duty; reversible swing jaws.

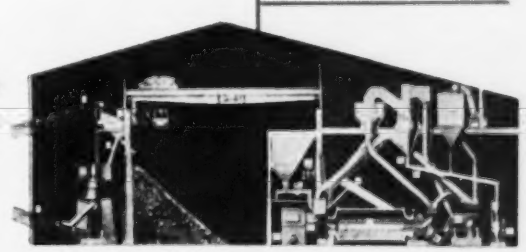


SLUGGER ROLL—Reduction variable from 2" to 10" while operating.



TUBE MILL—Drives KVS mills of any diameter, length.

SEND FOR ILLUSTRATED BULLETINS DESCRIBING ALL KVS PRODUCTS.



AIR SWEPT TUBE MILL—Produces 94% plus through 325 mesh when grinding —2" clinker.

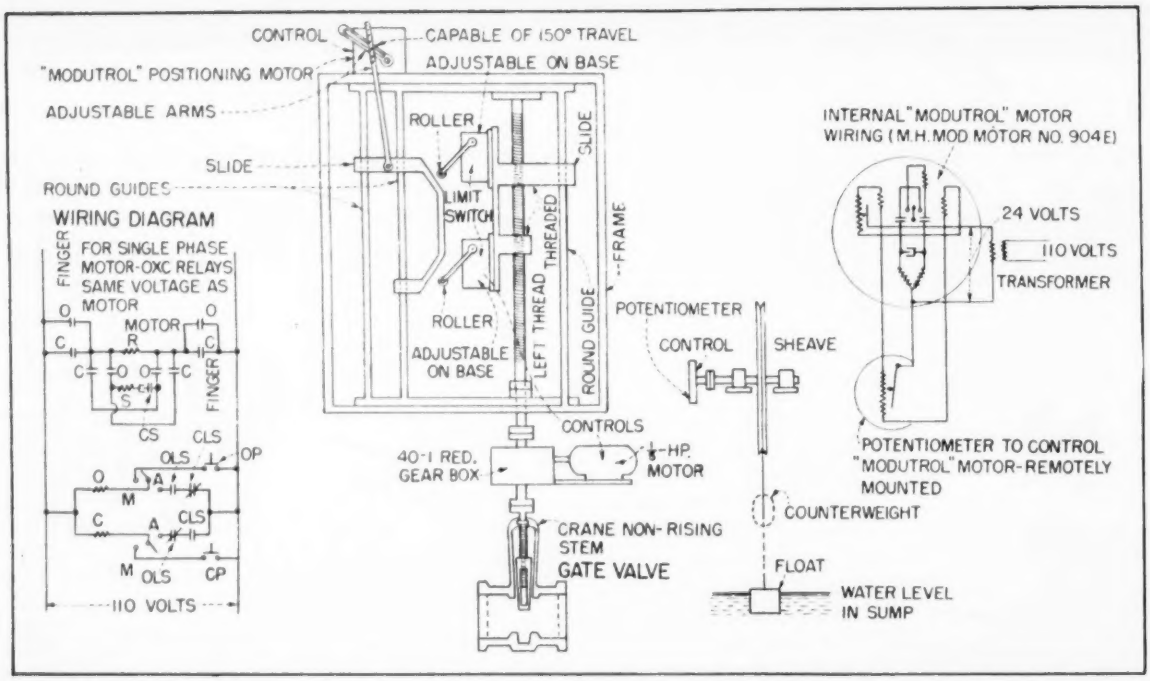
IT COSTS LESS.. TO OWN THE BEST!

KENNEDY-VAN SAUN

MANUFACTURING & ENGINEERING CORPORATION

TWO PARK AVENUE, NEW YORK

***FACTORY* DANVILLE, PA.**



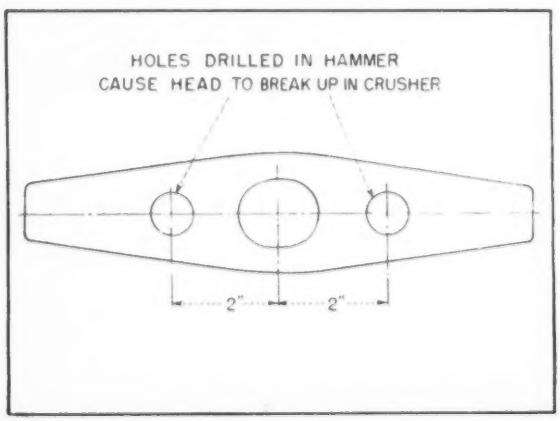
SYMBOLS USED ABOVE: CP and OP, push buttons for manual control of valves; CS, centrifugal throwout switch in starting winding circuit of single-phase motor; O, valve-opening relay; C, valve-closing relay; R, running winding of single-phase motor; S, starting winding of single-phase motor; OLS and CLS, two-pole contacts, one normally open, one normally closed; M A, one pole of two-pole double-throw switch. Blade thrown to M for operating valve manually, thrown to A for operating the control valve automatically.

Automatic Valve Controls Liquid Level

ALTON H. BAKER, chief electrician, Chief Consolidated Mining Co. Eureka, Utah, devised this automatic valve which controls the rate of pumping from mine workings, sumps, or tanks. Surface level of the water is held to plus or minus 6 in. Here's how it works:

A float on the liquid actuates a sheave wheel by a small cable attached to the float and a counterweight on the opposite end (over the sheave.) The sheave in turn actuates a potentiometer which controls the motions of a "modutrol" motor as to direction and extent. An arm on the "modutrol" motor, at right angles to its shaft, is linked to a slide of special design. This slide, moving back and forth, contacts arms of limit switches which control the operation of a small motor as to time and direction. This small motor turns screws through reducing gears, thus raising or lowering the limit switches with relation to the special slide, and varies the opening of the control valve on the pumping system. All of the parts are so adjusted that opening or closing of the control valve synchronizes with the rise and fall of the liquid level.

With two or more limit switches added, one will trip at the extreme opening of the valve and one will trip at the extreme closure of the valve, and open the "open or closed" relay circuit, thus preventing damage to the valve.



Holes in the Head?— O. K. in Hammers

WE THOUGHT THAT tramp iron collectors were standard as a means of keeping hammer heads, etc., out of crushers, but here is a new wrinkle which comes from Australian gold operations. A ¾-in. hole is drilled through each head of a spalling hammer before issue for use underground. (See drawing.) These are filled with lead or left as drilled. If an ordinary hammer gets lost in the ore and is carried into the Symons crusher, it may cause a jam and have to be burned out. The extra holes in this hammer, however, increase the likelihood that the hammer will collapse in the crusher and pass through.

STANDARD ENGINEER'S REPORT

DATA

LUBRICANT Calol Multi-Service Oils

UNITS Compressors 14x12 14x12 14x14 9x12 7½x12 10x14

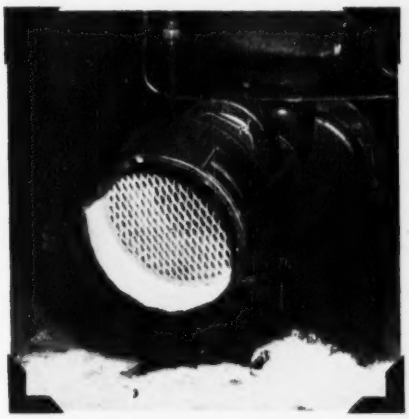
LUBRICATOR Force feed and crankcase

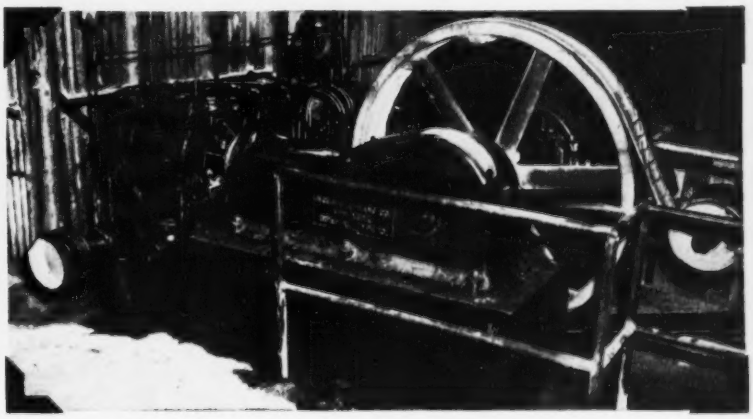
CONDITIONS Extreme dust conditions

PERIOD 7 years

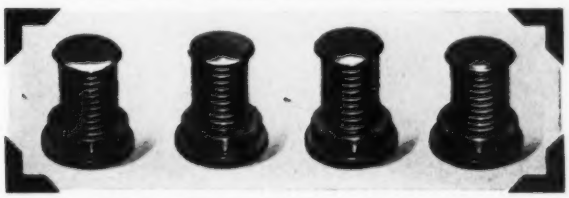
FIRM U. S. Lime Products Corp., Sonora, Calif.

Lime mine compressor rings still good after 7 years!





LUBRICATED WITH CALOL MULTI-SERVICE OIL 55X, this is one of three Ingersoll-Rand compressors that supply all air for the Sonora, Calif., mine of the U.S. Lime Products Corp. Heavy coating of lime dust on the air intake and floor indicates the extreme conditions under which the compressor works. Even so, when pistons were pulled for the first time after seven years, rings were found to have no deposits, ports and grooves were free and clean—and the entire assembly was returned to operation.



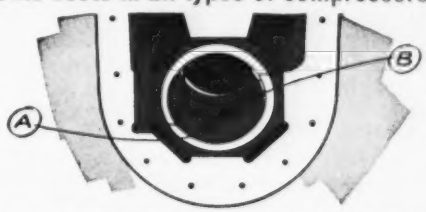
THESE VALVES, taken from the compressor's low side, get the first dust from the air intake. Note how they are free from all deposits.

FREE CATALOG: "How to Save Money on Equipment Operation," a new booklet full of valuable information, will be sent you on request to Standard Oil Company of California, 225 Bush St., San Francisco, Calif.

CALOL

TRADEMARK "CALOL" REG. U.S. PAT. OFF.

Now CALOL Multi-Service Oil cuts costs in all types of compressors



In crankcase and on cylinders, Calol Multi-Service Oil reduces wear and oil consumption—has cut consumption 20% in air compressors.

A. Oxidation-resistant compounds prevent formation of varnish. Detergent keeps contaminants suspended in oil, prevents foam.

B. Special compound assures "hot-spot" lubrication...covers surfaces rapidly.

Calol Multi-Service Oils also recommended for pumps, diesel engines, enclosed gears.

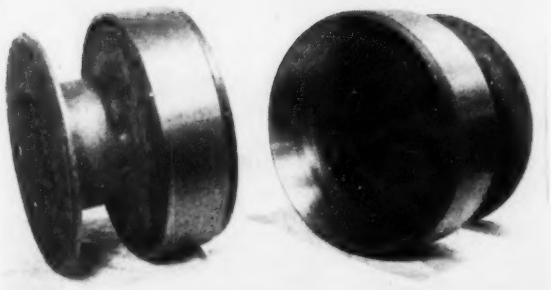
FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor handling them, write or call any of the companies listed below.

STANDARD OIL COMPANY OF CALIFORNIA
225 Bush Street • San Francisco 20, California

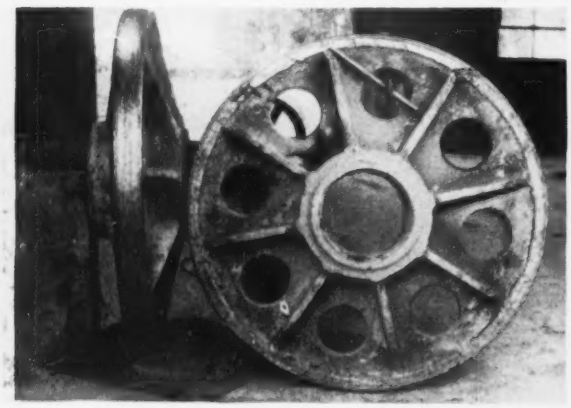
THE CALIFORNIA COMPANY
P. O. Box 780 • Denver 1, Colorado

STANDARD OIL COMPANY OF TEXAS
P. O. Box 862 • El Paso, Texas

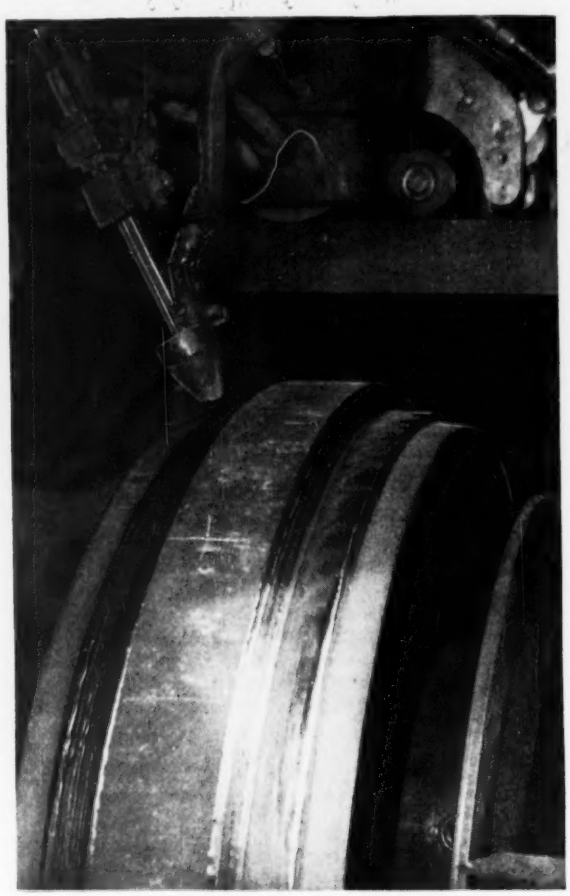
SINGLE AND DOUBLE FLANGE rollers for Caterpillar tractors rebuilt by automatic hard-facing methods.



COMBINATION CLUTCH and brake drum for tractor hard-faced automatically, and ground to size shown here.



IDLER WHEELS for Bucyrus-Erie 120-B shovel rebuilt with automatic hard-facing equipment.



IDLER FOR INTERNATIONAL HARVESTER TD24 tractor completely rebuilt and hard-faced automatically.

Hard-Facing Rebuilds Rollers

MANY PARTS OF TRUCKS, shovels, tractors, etc. used in open-pit mining can be restored to usefulness by modern hard-surfacing methods. Equipment used to apply hard-surfacing may be either manual or automatic. In the series of pictures shown here, parts hard-faced include clutch and brake drum for a tractor power take-off, tractor rollers, idler wheels on shovels, and tractor idler wheels. Similar jobs can be done on mill crusher parts, ball and rod mill trunions, brake drums, hoisting sheaves, car and locomotive wheels, and many others. This technique forms an important part of the preventive maintenance program at many mines where down-time of equipment units is reduced by forethought and maintenance planning. Photos shown, through courtesy of the Stoody Co., Whittier, Calif.

Track-Laying Time Saving

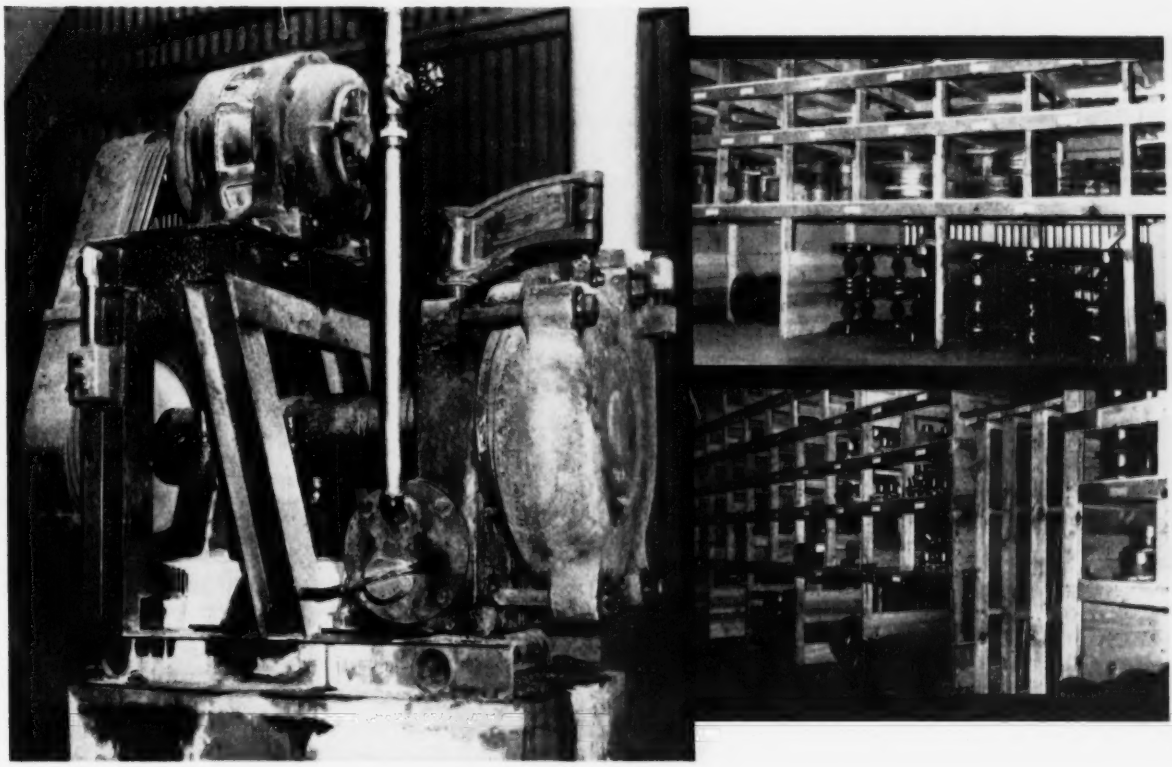
H. B. ESTABROOKS, mine foreman of the Burra Burra mine, Ducktown, Tenn., submits the following time-saving idea for track crews:

When replacing long stretches of worn rail, D. A. Newton, track foreman does it on "off-production" shifts. However, the track must be ready for production haulage on the next shift. He avoids the slow process of sawing rails and drilling fish-plate holes to couple the new rail to the old rail by the following series of unique time-saving operations:

He pulls enough spikes on the old rails to allow them to be jim-crowed to one side so he can fit the last two new rails to the old ties. Then he bolts standard switch points to the end of the new rails and fits them to the old rails where they were jim-crowed. The switch parts are spiked tightly to the old rail to make a safe temporary splice. The whole procedure saves hack-saw blades, drills, and allows considerable time for additional track laying during the shift.

WEMCO SAND PUMPS
stay on the job

Because they're tough...
And because these shelves are as near as your telephone



For protection against mill shutdowns and loss of operating time, here is Wemco's **two-way** plan to keep your sand pumps on the job:

FIRST — is the design of Wemco Sand Pumps. In every detail they're built to stand the abrasive wearing action caused by gritty pulps. Special wear-resistant alloys give maximum life to wearing parts which are easily accessible for replacement when necessary. Bearings and shafts are protected from moisture and grit by effective centrifugal seals.

SECOND — is Wemco's stockroom service that keeps **all parts** for **all sizes** available at **all times.** If ever your Wemco Sand Pump requires parts in a hurry, your telegram or phone call gets top priority attention. This prompt emergency service is standard procedure at Wemco, and is provided at no extra cost.

OTHER WEMCO PRODUCTS

Mobil-Mills • HMS Thickeners • HMS Pumps • Cone Separators • Coal Spirals Sand Pumps • Drum Separators • Dewatering Spirals • Fagergren Laboratory Units • HMS Laboratory Units • Agitators • Hydroseparators • S-H Classifiers Thickeners • Conditioners • Fagergren & Steffensen Flotation Machines • Densifiers

Next time you buy sand pumps, buy WEMCO. It's your assurance of reliability... backed up with parts and service... for steady and continuous pump performance.

WEMCO
WESTERN MACHINERY COMPANY
760-766 FOLSOM STREET — SAN FRANCISCO 7, CALIFORNIA

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- The Ore & Chemical Corporation, 80 Broad Street, New York 4, N. Y.
- Fraser & Chalmers (S.A.) Ltd., P.O. Box 619, Johannesburg, South Africa
- Lilestone & Co., Inc., P.O. Box 3368, Manila, Philippines
- United Development Corporation Pty. Ltd., P.O. Box 3460, Sidney, N.S.W., Australia
- Corporation Commercial Sudamericana S.A., Casilla 505, Lima, Peru

PERSONAL NEWS

ALBERT H. O'NEIL has been elected assistant vice president of Freeport Sulphur Co., Port Sulphur, La. Mr. O'Neil was formerly assistant sales manager.

Vernon F. Taylor, San Antonio, Tex., president and director of Peerless Oil and Gas Co. and a director of several other companies, has been named director of American, Zinc, Lead and Smelting Co., St. Louis, Mo., succeeding the late **Chester G. Breining.**

Dr. George A. Kolstad, physicist with the U. S. Atomic Energy Commission, Washington, D. C. has been appointed chief of the physics and mathematics branch in the Division of Research.

J. L. Mealy, former sales manager of the Thomson Phosphate Department of International Minerals & Chemical Corp., Chicago, Ill., has been appointed sales manager, direct application, rock phosphates.

E. P. Dunlaevy, vice president of Phelps Dodge Copper Products Corp., New York, N. Y., has been elected a director of G&W Electric Specialty Co.

George H. Love, vice chairman of the board of M. A. Hanna Co., Cleveland, Ohio, has been elected chairman succeeding **George H. Humphrey,** now United States Secretary of the Treasury. **Joseph H. Thompson** president, Hanna Coal & Ore Corp. has become chairman of the firm, and **Gilbert W. Humphrey** becomes president and a director.

D. A. Rhoades, Kaiser Aluminum & Chemical Corp., Oakland, Calif., has been elected president of The Aluminum Association. **A. V. Davis,** Aluminum Company of America, New York, N. Y., was re-elected chairman of the board and **Donald M. White** was reappointed secretary and treasurer.

W. S. Phillips, chief engineer, Howe Sound Co., has been appointed mine superintendent of the Holden mine, Chelan Division, Holden, Wash.

Ed Massey is Arizona's new mine inspector. He has named Thomas Phillips, A. H. Monroe, and Eldifenso Franco Chavez as deputies.

Howard Poland has joined the Phoenix, Ariz., office of the Accident Prevention Bureau, U. S. Bureau of Mines. He had formerly been mine superintendent of the Frances Mining Co., Fairmont, W. Va.

Dale C. Matthews, general supervisor of the Galigher Co., Atomic Energy Commission contract operations at Monticello, Utah, has transferred to the Utah Construction Co. for work in Korea in connection with tungsten mine rehabilitation efforts.

The British Columbia & Yukon Chamber of Mines re-elected **Dr. Harry V. Warren** of the University of British Columbia as president. Vice presidents are **S. J. Crocker** and **Henry L. Hill.** Honorary treasurer is **Walter B. Boucher.** Executive Committee: **U. S. Annett, Dr. W. B. Burnett, C. M. Campbell, Harry O. Dyer, G. S. Eldridge, A. D. MacGillivray, T. S. Mackay, Dr. Joseph T. Mandy, B. I. Nesbitt, J. A. Pike, John H. Rochfort, Matthew Sutton, Ross Thompson, R. W. Wilson, L. F. Wright, M. M. O'Brien.**

Marvin E. Johnson, superintendent at the Gross-Marble mine since 1945, was appointed assistant general superintendent of the Canisteo district, Oliver Iron Mining Division, U. S. Steel Co. **Hubert F. Bolton,** assistant superintendent at the Gross-Marble, succeeds Mr. Johnson as mine superintendent. **Wayne W. Beebe,** assistant superintendent at the Walker and King mines in Coleraine, was named assistant superintendent of the new Plummer mine, Coleraine. **Albert C. Prisk,** assistant superintendent of maintenance in the eastern district, is superintendent of maintenance in the Canisteo district; **Carl R. Peterson,** general electrical foreman, succeeds Mr. Prisk as superintendent.

Dr. Wallace G. Fetzer, geologist with Vanadium Corporation of America at Durango, Colo., is now with Oglebay, Norton & Co. in Duluth.

Harry Shere, Chisholm, Minn., master mechanic at M. A. Hanna Co.'s Douglas mine, has retired after 36 years' service.

A. W. Tellefsen, Marble, Minn., engineer and inspector for the Arthur Iron Mining Co. for 28 years, has retired.

Frank Nichols, Pickands, Mather & Co., Duluth, Minn., retired as master mechanic at the Mahoning mine after 22 years with the company. **Frank Fochtman** also retired as superintendent of concentration plants.

Alfred O. Quinn has been elected president of the American Society of Photogrammetry. Mr. Quinn heads the engineering and field surveys divisions for Aero Service Corp., Philadelphia, Pa.

Raymond John Wean, president and director of the Wean Engineering Co., Warren, Ohio, has been elected director of Cleveland-Cliffs Iron Co., succeeding the late **W. H. Gerhauser,** formerly president of the American Ship Building Co.

H. B. Hardy, formerly representative of the Carborundum Co. in the Southeast, has joined the engineering department, Georgia Iron Works, Augusta, Ga. Mr. Hardy is eventually to head the sales and service office in Bartow, Fla.

Richard Creasy, former chief engineer of Georgia Iron Works, Augusta, Ga., has joined Virginia-Carolina Chemical Co. as assistant chief engineer at Nichols, Fla.

Robert N. Bayless, former treasurer of Jaques Manufacturing Co., Chicago, Ill. and general manager of its subsidiary, General Cap and Closure, has been appointed director of management planning for Calumet and Hecla, Inc., Calumet, Mich. **Edward C. Ames,** formerly with Owens-Corning Fiberglas Corp., Toledo, Ohio, is director, employee and public relations.

DR. EDMUND C. HARDER, Montreal, senior geologist for Aluminium Ltd. and subsidiaries since 1928, has been appointed a member of the board, succeeding the late HON. LEIGHTON McCARTHY.

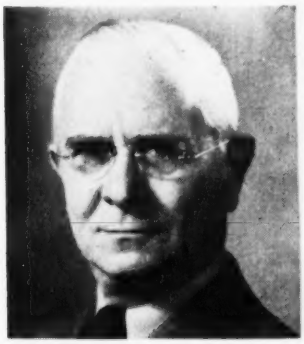
Paul Piscevich, Kimberly, Nev., has been appointed deputy state mine inspector succeeding **Cecil Morrison,** who resigned to join Isbell Construction Co.

Roy Hardy, Reno, engineer for Getchell Mines Inc., is president of the Nevada Mine Operators Association. First vice president is **John C. Kinnear Jr.,** Kennecott Copper Corp., and second vice president is **Percy Dobson,**

of Summit King Mines Inc. Executive committee members are **Walter S. Larsh, Norman E. Hansen, S. H. Williston, George W. Mitchell, A. E. Millar,** and **Charles H. Segerstrom Jr.**

Frank La Grange, head of La Grange & Co., New York, N. Y., and **Eugene Moyne,** Las Vegas, Nev., were elected to the board of Lead Kings Mine Co., Las Vegas, Nev.

S. S. Goodwin, manager of mines of the New Jersey Zinc Co., New York, N. Y., has been elected a vice president, retaining his old title.



CHARLES SAWYER, former Secretary of Commerce, has been elected a director of Kennecott Copper Corp., New York, N. Y.

Larry Nahai, chief, Near East Branch, Region IX, U. S. Bureau of Mines, is on a four-month observation tour of important mining areas in 12 countries in South Asia and the Near East.

George C. Selfridge, chief, Iron and Ferro-Alloy Division, Defense Minerals Exploration Administration, has been assigned special assistant to the administrator.

G. W. Bone, works director since 1948 of Davey, Paxman and Co. Ltd., Standard Ironworks, Colchester, England, has been appointed assistant managing director.

William D. Hardeman, Nashville, has been reappointed Tennessee State geologist. Promoted from assistant geologist last August, he succeeded Herman W. Ferguson.

Francis Cameron, vice president, was elected to the board of St. Joseph Lead Co., New York, N. Y., succeeding **George H. Love,** resigned. Mr. Love is assuming more responsibility at M. A. Hanna Co., owing to **George Humphrey's** appointment as Secretary of the Treasury.

Robert H. Nelson and **Irving G. Irving,** operators of manganese mines in the western part of Butte, Mont., have announced their partnership as geological consultants, with offices in the Hirbour Building, Butte.

Ralph E. Knight, assistant general manager, chemical division, Kaiser Aluminum & Chemical Corp., Oakland, Calif., has been promoted to vice president. **W. R. Woodman,** manager of the chemical division operations, has been named manager of the aluminum division's raw material operations. **Frank M. Cashin,** general sales manager of the chemical division, is manager of the division. **Jack W. Watson, Jr.,** West Coast manager of aluminum sales, has been appointed assistant to the vice president and general manager of the corporation. **R. A. Fratus,** assistant to the comptroller, is head of the new analysis and planning department.

J. S. Peterson, vice president and and general manager of Benguet Consolidated, has returned to the United States after 15 years' service with his company. **Ralph Crosby,** formerly general superintendent of Benguet succeeds Mr. Peterson; **A. P. Davidson,** formerly general superintendent at Masinloc, succeeds Mr. Crosby. **Virgil Frank** is superintendent at the Zambales property.

William D. Webb, superintendent at the Scranton mine, Pickands, Mather & Co., Duluth, Minn., has been appointed superintendent at the Mahoning mine, succeeding **W. G. Brown,** retired. Mr. Brown was with the company for 51½ years, for 27 as superintendent at the Mahoning mine. **E. C. Sponberg** succeeds Mr. Webb as superintendent at the Scranton mine, Hibbing. **Robert T. Bell,** superintendent of Cuyuna Range mines, is now superintendent of the Bennett mine at Keewatin, succeeding **A. E. Schneider,** in charge of the Bennett for 33 years. **Hayden Sears,** is now superintendent of the Cuyuna Range mines at Crosby, succeeding Mr. Bell, and **J. P. Schemmel** is general superintendent of Cuyuna.

J. P. CAULFIELD has been appointed general manager, western mining divisions, Kennecott Copper Corp., Salt Lake City, Utah, succeeding LOUIS BUCHMAN, retired.

David L. Gamble has been appointed manager of research for the New Jersey Zinc Co., Palmerton, Pa., succeeding **George F. A. Stutz** who has been transferred to the New York office as development engineer. **Robert K. Waring** has been advanced to assistant manager of research, formerly Mr. Gamble's position.

OBITUARIES

John Harvey, pioneer Leadville, Colo. mining operator, passed away in Denver at 85. Mr. Harvey operated the Buckskin Joe mine, Alma, Colo.

George V. Savitz, district sales manager for agricultural potash in the Potash Division of International Minerals & Chemical Corp. died Jan. 15 in Carlsbad, N. M. at the age of 73.

Frank Hutchinson, Duluth, Minn., 78-year-old retired consulting engineer, died on Jan. 5. Mr. Hutchinson, one of an engineering committee, which investigated iron ore developments in Manchuria, was associated with the late W. H. Crago in Duluth.

Oscar Benton Brown, 79, Kenmore, Wash., died Jan. 4 in Portland, Ore. Mr. Brown, formerly president of the North Central Washington Mining Council held mining interests near Grand Coulee Dam and helped develop Howe Sound Co.

APPRECIATION

Charles W. Stoops

Charles W. Stoops, long associated with the zinc and lead mining industry in southwest Wisconsin, passed away Jan. 23, 1953, at Madison. He was born 76 years ago in Decatur, and moved with his parents to Antigo, Wis. at an early age. He later attended Oshkosh State Teachers College, taught in the public schools for a number of years, and then attended the University of Wisconsin and graduated with a degree in geology.

After graduation in 1912, he became associated with the Vinegar Hill Zinc Co. at Galena, Ill., during World War I was employed by the Grasselli Chemical Co., and traveled extensively in western United States and Canada examining pyrite deposits. At the close of the war, he returned to southwest Wisconsin and was associated as engineer, manager, and consultant for several mining companies, and is credited with constructing and operating the first successful zinc flotation mill east of the Mississippi River at the Prairie Mine near Linden, Wis.

Well-known, respected and admired by all, "Charley" Stoops was for 19 years a member of the Board of Regents at the Wisconsin Institute of Technology, Platteville, serving as secretary of the board for 15 years.

His example inspired many a young man to an education for the industry, and his endeavors were, in a large measure, responsible for the increased zinc production from the Illinois-Wisconsin district.

At the time of his passing, he was an ore buyer for American Zinc Co.

R. R. REYNOLDS
N. W. JUDD

Shullsburg, Wis.

(*Continued on p. 124*)

(Continued from p. 123)

Franklin E. Turton

Mr. Turton came to Chile in 1915, the same year Kennecott Copper Corp. acquired the stock of the old company, to work as a young engineer in the mines of the Braden Copper Co., soon after graduating from the University of California and with Braden Copper he remained and labored for 37 uninterrupted years until death found him struggling hard, intelligently and kindly, as was his wont, to prevent a needless strike. Thus, it can be said with justice that he gave to his organization his very last thoughts and efforts.

He saw Braden Copper grow from a very modest beginning to boast of a very modern and efficient 30,000 tons a day mill, where molybdenite is also recovered; the smelter moved down from Sewell to Caletones and the old blast furnaces and nodulizing kilns replaced by a modern and efficient roaster-reverberatory plant that produces one of the best known makes of fire-refined copper in the world; the tailings ponds removed from the high and dangerous canyons up near the mill-site to the flat and safe valley of Cauquenes and efficiency improved in all departments. He also saw and felt year by year the hard impact of rising taxes and working costs that had to be met by improved technological methods and better machinery at altitudes where working conditions are not easy and winters very severe. During two world wars, he worked hard to help make record outputs of the red metal so badly needed to win those struggles in which the very existence of democracy laid at stake.

Only a year ago, he was made a vice president of the enterprise for which he had worked so long and efficiently, thus becoming the first official of Kennecott in Chile to hold such a high position.

In 1950, the Chilean Government bestowed on him the "Orden al Mérito" as a token of the appreciation and esteem in which the government and the people of Chile regarded his accomplishments in developing the copper industry. During his long sojourn in the country, he became extremely well acquainted with the psychology of the native workers whom he understood and could handle well.

His sudden passing away was a very hard blow to his many friends in Chile who had hoped to see his vigorous personality at the helm of the Braden Copper Co. for many years yet. The numerous appreciations that appeared in the Santiago and Rancagua newspapers when his death became known and the speeches delivered at the burial in the General Cemetery of Santiago, were moving proofs that he was regarded in all circles as one of us.

FERNANDO BENITEZ
Caja de Crédito Minero
Santiago, Chile, S. A.

NEW BOOKS

Lead in Modern Industry. Published by Lead Industries Association. Complete coverage is given to the manufacture, applications, and properties of lead, lead alloys, and lead compounds in this text. Designers, product engineers, builders of industrial and chemical plants, and persons interested in various phases of the marketing of lead will find this an authoritative and valuable reference work. Here are a few of the interesting chapter headings listed in the book: From Mine to Finished Metal; Forms and Fabricating Processes; Lead Storage Batteries; Lead in Modern Chemical Construction; Corrosion Resistance of Lead and Lead Alloys; Radiation Protection; Other Metallic Lead Products and Alloys; Metal Protective Lead Paints; Properties of Lead Compounds and Alloys; Physical Constants of Lead Alloys. Published by Lead Industries Association, 420 Lexington Ave., New York 17, N. Y. Pp. 230. Price $1.50.

Noise. A series of lectures presented at the University of Michigan School of Public Health and the Institute of Industrial Health conference Feb. 5-8, 1952. Here's a report that should find its way into the working library of forward-looking personnel and safety engineers concerned with the physical welfare of workers. Since mines, mills, and smelters are sometimes noisy places, it's not too early to alert the industry to the fact that noise should require some attention particularly because it may result in physical damage to workers. The chapter on "Industrial Loss of Hearing—Medical Aspects" will prove very interesting to management in general. The contents of the book are authoritative, having been contributed by experts in many fields dealing with sound. In brief this report covers the causes, effects, measurement, costs, and control of noise. Distributed by The University of Michigan Press, Ann Arbor, Mich. Pp. 192.

Copper Venture. By Kenneth Bradley, noted authority on African affairs. To many mining men, Nchanga, Nkana, Mufulira are just hard-to-pronounce names of fabulous copper properties somewhere in the steaming interior of Darkest Africa. If your impressions of the Copper Belt of Northern Rhodesia, which includes these properties plus that of the famous Roan Antelope, are similarly hazy, this book offers a delightful opportunity to acquaint yourself with the area and the colorful history of the Copper Belt. It dates back to 1902 when William Collier shot a roan antelope, and where it lay, found the first copper-stained outcrop indicating a vast orebody that eventually became the £10-million Roan Antelope mine. Of the climate, the author has this to say, "Everyone who has ever lived in Africa, particularly in its high interior, is homesick for it until he dies . . . much of the rainy season is like an English April. Logfires in the evening, and sweaters before breakfast are the rule for more than half the year."

Against a rich background of history, and description of the area and its society, Copper Venture is basically an account of mine-making in Northern Rhodesia, the British Empire's greatest producer of copper. Based on fact, it reads like fiction. Published by Mufulira Copper Mines, Ltd., and Roan Antelope Copper Mines, Ltd. Available at Walter E. Skinner, 20 Copthall Ave., London E.C. 2. Pp. 112. Price 16s. 3d.

Canadian Deposits of Uranium and Thorium. By A. H. Lang. This report is a summary of a vast amount of information obtained on Canadian uranium deposits prior to 1950. Because of the intense activity in Canada's current exploration program, the book naturally does not contain information on the more recent discoveries. Nevertheless it will serve as a useful guide to exploration-minded companies and individuals. Part II of the report covers the following general subjects; mineralization, types of deposits, distribution of deposits, origin of mineralization, wall rock alteration, prospecting and exploration methods. The balance of the report describes and locates numerous individual deposits in nearly all provinces of Canada. Published by the Canada Department of Mines and Technical Surveys, Geological Survey of Canada, Ottawa, Canada, Pp. 173. Price $1.

The following publications may be obtained from the U. S. Bureau of Mines Publications Distribution Section, 4800 Forbes St., Pittsburgh 13, Pa.:

R.I. 4928. Progress Report on Pegmatite Investigations in South Dakota. By S. M. Runke, D. H. Mullen, and J. B. Cunningham. Pp. 46.

R. I. 4929. Refractory Properties of Pacific Northwest Chromites. By H. J. Kelly, K. G. Skinner, M. E. Tyrrell, A. W. Goring. Pp. 38.

R.I. 4931. Formation of Dithionate and Sulphate in the Oxidation of Sulphur Dioxide by Manganese Dioxide and Air. By A. E. Back, S. E. Ravitz, and K. E. Tame. Pp. 13.

R.I. 4921. Maple Mountain—Hovey Mountain Manganese Project, Central District Aroostook County, Maine. By N. A. Eilertsen. Pp. 118.

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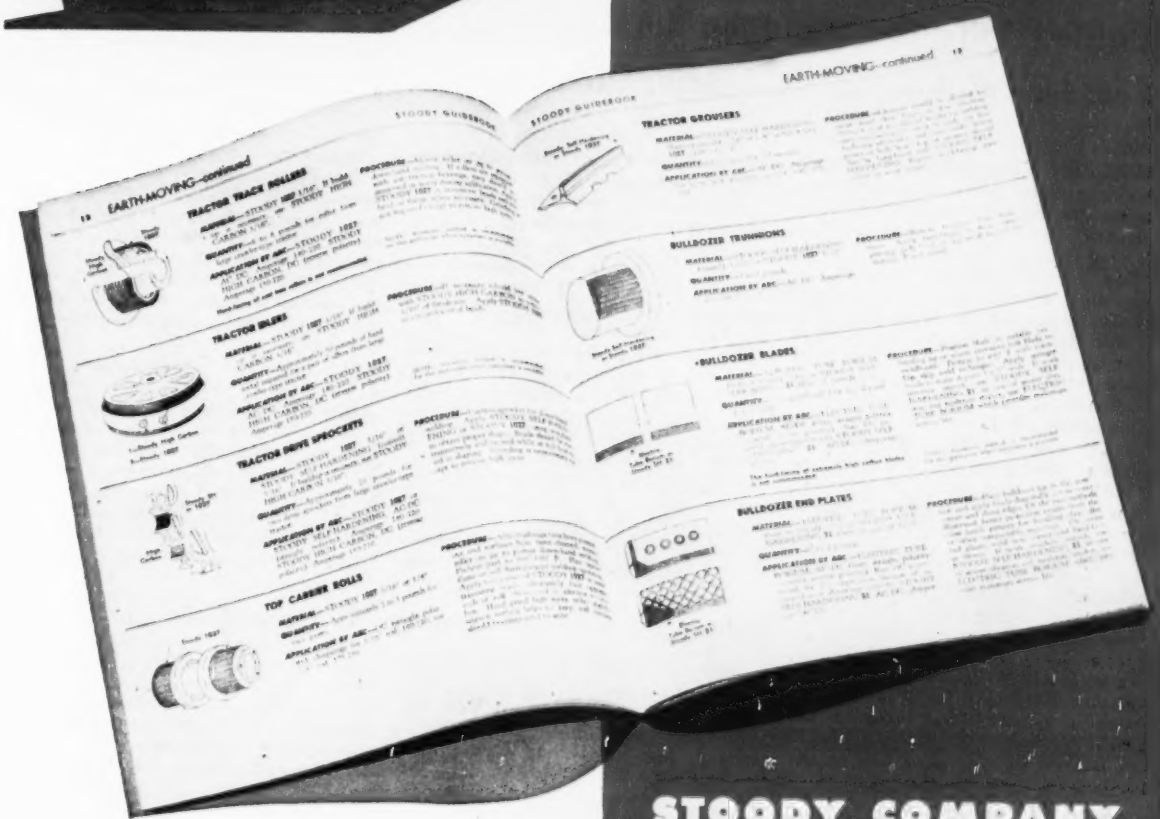

STOODY COMPANY

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THIS MONTH

W. C. PAGE, JESS LARSON, FELIX WORMSER, J. H. TAYLOR (speaker) participate in a serious discussion of the problems of lead and zinc products.

C. M. Peterson Photos

R. S. PALMER and BLAIR BURWELL (speaker) welcome mining guests to the convention.

Unified Industry Stand on Imports Features Colorado Association Meeting

UNITED AS NEVER BEFORE on a major industry issue, the registrants at the National Western Mining Conference sponsored by the Colorado Mining association in Denver, Feb. 12-14, joined in approval of a plan to establish a sliding-scale of import taxes on lead and zinc from abroad.

Favored alike by operators of large and small-scale properties, the plan grew out of a pre-convention meeting in Denver of the National Emergency Committee on Lead and Zinc, Otto Herres, vice president of Combined Metals Reduction Co., chairman. Pointing out that violent fluctuations in metal prices, as at present, endanger the domestic industry, and that current low prices are caused by pressure of surplus metal from abroad, the committee suggested its plan as a market-stabilizing device. Major provisions are as follows:

Enactment of a sliding-scale import tax on lead and zinc such that, whenever the domestic price of either falls below a specified base price, a tax should be levied on imported metal, the amount varying according to the level of the domestic market.

A base was suggested of 15½c. for lead and 14½c. for zinc, the tax to be 1c. per lb. for each 1c. drop below these levels. The base would be adjusted in line with the BLS index of commodity prices, farm and food prices excepted. Metal in ores would be taxed at 0.7c. for lead and 0.6c. for zinc. No tax would be levied if the domestic market were at or above the base price level.

The convention heard a panel of industry members voice approval of the plan. Jess Larson, former GSA administrator, said of the plan in addressing the group, "I think you have hit upon a sound and practicable solution to your problem."

In presenting details of a specific plan for a sliding-scale import tax, Felix Wormser, vice president, St Joseph Lead Co., pointed out that any proposal to stabilize lead and zinc prices should "observe the cardinal principle of least interference with the market place." The suggested sliding-scale tax, he said, would be automatic in operation, require no payments from government, and would involve no embarrassing and expensive price-support or subsidy programs like those on certain farm products.

Mr. Wormser's suggestion called for a base price of 16c. per lb. with a tax of 0.75c. per lb. on imported metal for each 1c. drop below 16c.

In reviewing the position of gold at a luncheon meeting, Charles White Merrill, U. S. Bureau of Mines, said that although there was little chance of an early rise in the price of gold, he felt sure that if they are patient, "gold miners can anticipate with confidence an eventual regaining of a prosperous position, such as existed in the 1930's."

In a session on uranium, miners indicated dissatisfaction with current sampling procedures, transportation allowances, and settlement contracts. Sheldon P. Wimpfen, speaking for the AEC, promised the Commission's careful consideration of the various points raised. He repeated earlier assurances of the long-term strength of the Government's need for uranium.

Inland Steel Leases Orebody At Steep Rock

A $50-MILLION IRON ORE project for Inland Steel Co. on Steep Rock Lake, Ont., was announced Feb. 25. The Caland Ore Co., Ltd., Inland subsidiary, has leased one of the orebodies in the Falls Bay area that Inland has been drilling under option from Steep Rock Iron Mines, Ltd., for the last four winters. Test drillings indicate at least 50-million tons with greater tonnage possible, according to P. D. Block, Jr., vice president in charge of raw materials for Inland. Quality and structure of the ore are excellent.

Inland plans to invest $50-million over seven years to develop the new orebody. Mr. Block expects to ship 3-million tons annually when in full production. The agreement runs for 99 years and provides for payment of royalties based on the market value of the ore shipped.

Under the lease, Inland will loan Steep Rock $8-million, repayable after mining operations start. This will afford the Steep Rock company additional working capital to speed up development of its own new iron ore mines.

IN MINING

Germanium Seekers Go Up the Chimney

THE FUTURE of germanium mining may be in chimneys. Bureau of Mines, faced with predictions the electronics industry will require 40,000 lb. a year by 1956, has men in the field collecting samples of coal ash from public utilities plants for chemists striving to standardize a method to determine the germanium content of coal ash and flue dust.

The nation is getting only 6,000 lb. a year at present, most of it from Eagle-Picher Co.'s Henryetta, Okla., electrolytic zinc refinery, where recovery from sludges amounts to 1 lb. per 2.5-million lb. of zinc ore. American coals contain about 0.001% germanium. That's $7 worth per ton with 100% recovery, but Regional Director H. P. Greenwald said the Bureau planned research later on to find a more economical method for recovery from coal.

R. C. Corey, of Pittsburgh, northeastern regional chief of the Bureau's coal branch, said the search at this time is concentrated on the ash pits and smoke stacks of central station power plants that burn upwards of 100-million tons of coal a year. He stated that the Bureau is not now able to make germanium assays of coal and ash samples submitted by mine owners and other chimney owners but suggested interested persons write for instructions to Pennsylvania Coal and Coke Corp. (30 Pine St., New York) who have undertaken to make analyses of this type.

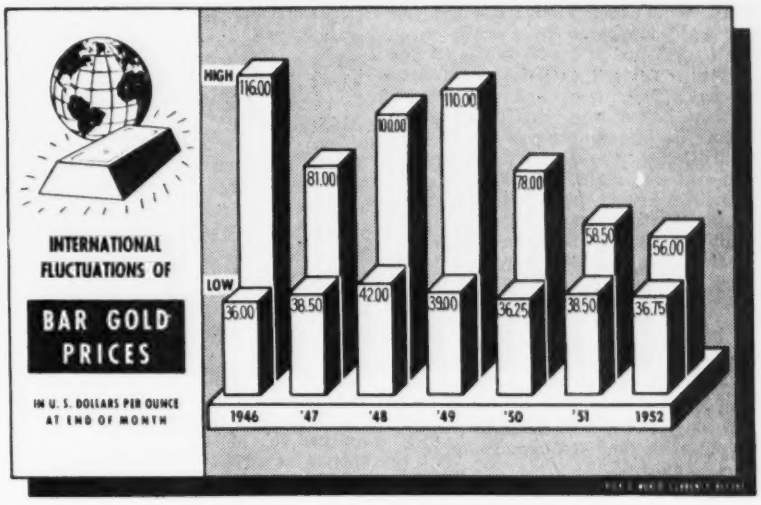
Independents Contribute Heavily to Lake Shipments

INDEPENDENT IRON mining companies have become an important factor in Lake Superior, particularly Mesabi Range, ore production. During the 1952 shipping season they forwarded 3,368,227 tons; compared to Republic Steel Corp.'s 1,890,397 tons, Oglebay, Norton & Co.'s 1,024,140, and Snyder Mining Co.'s 609,235.

W. S. Moore Co., of Duluth, headed the eight producers which made up the independent total, with 672,312 tons from eight properties. Its largest contributor was the Prindle, with 189,269 tons, followed by the Pilot Annex and the Judson, each of which shipped more than 150,000 tons. The other five properties are credited with tonnages ranging from 50,291, at the Hanna mine, to 11,736 at the Pilot. Warren S. Moore, Duluth, is president of the company, and H. E. Reese, Hibbing, is general manager.

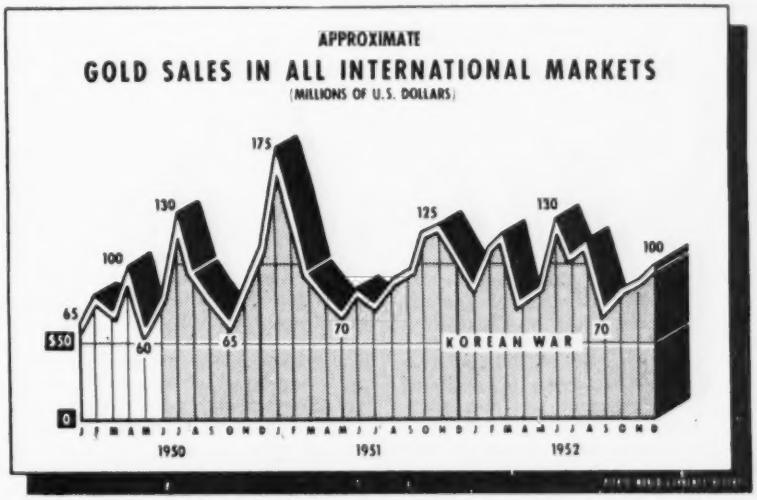
Next largest shipment was the com-

(*Continued on page 128*)



Gold Prices Approach Stability . . .

FREE GOLD PRICES level off as world currencies seek equilibrium. High prices from 1945 through 1949 reflect inflation, world shortage of commodities, and inadequacy of consumer production facilities immediately following World War II. Civilian economy was reestablished—by and large—in 1949, bracing world currencies and reversing the trend of gold prices. Outbreak of war in Korea had less effect on the gold market than might have been expected. Average prices in the past three years show, says Franz Pick, publisher of *Pick's World Currency Report*, that "unrest in currencies has died down, and currencies have attained a certain degree of stability—an attainment possible only as a result of the gradual rebuilding of the world economy."



. . . As Sales Hold An Even Keel

FREE MARKET GOLD SALES held up at 31-million oz. in 1952, the slight decline from 31.1-million oz. in 1951 reflecting a small decline in average price, while estimated private hoards rose from 11.1 to 11.9-million oz., up 7%. Korea had little effect, trading volume of 1949 having been maintained in 1950 and since—at about 24% above volume of officially mined gold in the world. Value of sales was $1.170-billion in 1952. Mine production in 1952 was 24-million oz. exclusive of the USSR. In 1952, France—as in preceding years—had the most important gold market in the world, trade averaging approximately $40-million worth a month, about 80% of it in coin.

bined Pacific Isle Mining Co. and Hedman Mining Co. (with Pacific Isle Mining Co. as operator). It was 524,789 tons. The York mine at Nashwauk (operated by Coates & Tweed for 30 years) was their heaviest shipper, with 131,844 tons. Pacific Isle stripped an additional area to uncover some lean wash ore and add to the life of the pit. Their Uno-Kerr group produced 90,896 tons and the North Shiras, 89,444 tons. Production came from 18 different sources on the Mesabi Range, the largest number of units of the eight operators and the lowest average production per unit. Hugh H. Harrison, Hibbing, is president of Pacific Isle, and John D. Boentje, Jr., Hibbing, is general manager.

Third in volume was Zontelli Brothers, Inc., of Ironton, the only one of the group to have shipments from three ranges. Of 491,315 tons, 424,818 came from the Cuyuna Range, where the Virginia mine was first with 131,613 tons; 598 tons came from the Mesabi Range (the Graham being foremost) and 65,899 tons of Gogebic Range ore came from the Ironwood concentration plant. The crude for this plant was mined as much as 50 years ago and placed in stockpiles as too lean to ship at that time.

Highest Rate Per Mine

E. W. Coons Co., of Hibbing, produced 435,386 tons from three Mesabi Range mines: the Genoa-Sparta, the Sidney, and the Julia, giving the largest average per mine of any company in the group. The Genoa-Sparta provided 220,684 tons, one of but two mines in the entire list to produce over 200,000 tons during the season. The remaining tonnage was about equally divided between the Sidney and Julia mines. The company operates a modern concentration plant near Eveleth, owned jointly by it and Pacific Isle. W. C. Cohoe, Hibbing, is president, and Duane Myers, Hibbing, is general superintendent.

Rhude & Fryberger, Duluth, follows closely with 423,366 tons from four properties. The Pennington mine's 260,239 tons was the largest single shipment. The Pennington and the South Hillcrest, both on the Cuyuna Range, shipped about 62% of the company total, the Mesabi Range Troy and Seville mines completing the total. Rhude & Fryberger are now stripping the old Boeing mine in Hibbing in cooperation with the Cleveland Cliffs Iron Co. J. O. Rhude, Hibbing, and R. M. Fryberger are the firm members.

Pioneer Mining Co. shipped 364,489 tons of concentrates from its Mary Ellen mine at Biwabik. It is the only company in the list to make its entire production from a single property. In 1951 it shipped 464,820 tons. The company, which has a bonus system, attributes its success to skillful operation of a not too tractable ore, a well

(*Continued on page 130*)

News Briefs

PRESS DISPATCHES from Peking to Moscow have been describing extensive iron deposits, said to have been discovered recently in northern China, as close to the surface and high in grade. The reports said the location is within an area marked for industrialization.

•

DIRECTORS of both companies have agreed to merge Federal Mining and Smelting Co. into its parent company, American Smelting and Refining Co., which owns 55% of Federal. Stockholders will be asked to give approval immediately following annual meetings of the two firms, April 13 in the case of Federal, April 28 for AS&R.

•

DPA HAS REACHED agreement with Canada and England to purchase on a temporary basis an additional 44-million lb. of Canadian aluminum, this to offset U. S. production losses attributed to power shortages in the Pacific Northwest and the Tennessee Valley. Aluminium Company of Canada will supply most of the metal, all of which is to have been delivered to this country by the end of this month and repaid to Britain—through resale to the Canadian producers—as the British call for deliveries in 1954 and 1955. The deal brings to 121-million lb. the total amount of aluminum thus temporarily diverted in recent months.

•

CHARLES R. HOOK, chairman of the board of Armco Steel Corp., christened the company's namesake, the **Armco**—new flagship of the Columbia Transportation Co. fleet—Jan. 24 at American Ship Building Co.'s Lorain, Ohio yards. She slipped down the ways only two months after her sister ship, the Reserve, named for Reserve Mining Co. Each of the new ships can carry from 18,000 to 20,000 tons of cargo, measures 647 ft. in length, 70 ft. across the beam, 36 ft. in depth., is equipped with steam-driven turbines with oil-fired boilers to develop about 7,000 hp. Together, they cost more than $11-million. Columbia Transportation, an Oglebay, Norton and Co. subsidiary, built both ships.

•

A HERETOFORE unknown mineral rich in uranium and thorium has been identified and dubbed cheralite after Chera, ancient name of the State of Travancore, India, where the mineral was first discovered by officials of the British Geological Survey and Museum, Department of Scientific and Industrial Research. It's 31% thorium oxide, 4% uranium oxide.

•

A PILOT ATOMIC POWER plant will start going up in the Detroit area this year if the AEC approves. It would feed electricity into ordinary power lines. Twenty Detroit Edison nuclear engineers who recently completed studies in nuclear physics are now working out solutions to technical problems standing in the way of construction of a power plant.

•

IF EXPANSION PLANS announced in 1951 and 1952 materialize, a Norwegian Aluminium Co. survey finds, free world production of aluminum will be increased about 1-million tons a year within three years. The survey calculated last year's output was almost as great as the record 1.87-million tons turned out in 1943.

•

S. JAPHET AND CO., Ltd., observes in its Bullion Review for 1952 that resistance to an increase in the official gold price has been softening and that a more liberal regulation of gold dealing in London may be in the offing. The publication estimates that 10-million oz. of new gold passed into the free market during the year, 8-million oz. of which was mined in the British Commonwealth of Nations.

•

RUST PROCESS Design Co. of Pittsburgh, is designing a $25-million plant for Carborundum Metals Co., Akron, N. Y., to produce zirconium and hafnium metal, starting in July. Carborundum Metals is a subsidiary of Carborundum Co.

•

MICROWAVE FACILITIES being installed by Freeport Sulphur Co. for communication between its plant at Garden Island Bay, La., and New Orleans shipping points and other plants is said to be the only one FCC has ever authorized for an operation of this sort. Licenses ordinarily are granted only to pipe-line and power companies. The $15-million Garden Island Bay plant is scheduled for completion late this year, will produce 0.5-million long tons of sulphur a year. Two dirt lifts have been set up around the reservoir by dragline bucket, and one of two drilling rigs at the site is in operation.

•

AMERICAN METAL CO., Ltd., announced that Mufulira Copper Mines, Ltd., Nchanga Consolidated Copper Mines, Ltd., Rhokana Corp., Ltd., and Roan Antelope Copper Mines, Ltd., will launch a five-year program entailing expenditure of £2-million for improvement of native housing and living conditions on the Northern Rhodesian copper mines.

•

A. J. WELLS director of Rambler Mines, said a plant will be built to process what he described as a rich and extensive ilmenite deposit recently discovered over an area of 1½ x 4 mi. near Baie Verte, White Bay, Newfoundland.

•

AN ARGENTINE syndicate headed by Salim Chacur has obtained authority to build a tin smelter in Bolivia. It's part of an ambitious program requiring an immediate capital outlay of $13-million on the part of the syndicate—all of it to be invested in Bolivia.

•

IT'S REPORTED that National Stils, a New Orleans concern, is interested in an intensive search for iron in the Andes.

DOW

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To keep your **GRINDING MILLS** (upper right) operating at peak efficiency at all times, Hardinge has developed the "Electric Ear" (center right), a unique feed control that regulates the feed rate by listening to the sound of the rotating load.

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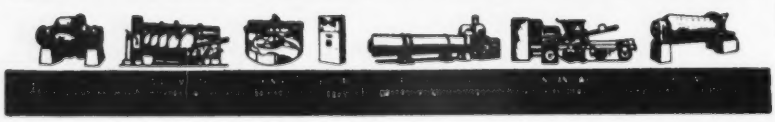
*These figures are based upon several hundred tested units.

HARDINGE



Lakes Iron *(Continued)*

designed concentration plant and a crew of cooperative employees with a low turnover. Patrick Butler, St. Paul, is president; Frank S. Bergstrom, Eveleth, is vice president and manager, and H. F. Manseau, Biwabik, is superintendent.

Lean Ore Treated

Charleson Mining Co. produced 246,496 tons. Except for 69,162 tons from the Glen mine stockpile at Chisholm, all of this came from its concentration plant, which treats lean ore from old stockpiles at the Missabe Mountain and Minnewas mines. E. F. Remer is president and general manager; Charles H. Remer, Hibbing, is vice president and general superintendent, and J. C. Henry serves the company as superintendent.

Haley-Young Mining Co. had a production of 210,074 tons from the Minnewas, Mississippi No. 1, and Elbern mines, all on the Mesabi Range. The Elbern, which shipped about 65% of the company's total, is an open-pit mining operation between Chisholm and Buhl.

Production of these companies comes largely from mines and stockpiles considered too marginal by the older mining companies. These companies have produced a large tonnage of commercial ore, provided employment for many men, and made a profit from properties that have been rejected or in some instances never even considered at all by the larger operators.

Erie Mining Co. Ownership Reshuffled

YOUNGSTOWN SHEET & TUBE CO. is reported to have sold part of its interest in Erie Mining Co. to the Steel Company of Canada. This transaction leaves Bethlehem Steel Co. as the top dog in Erie with 45% of its ownership, Youngstown (formerly holding 45%) with 35%, Interlake Iron Corp. with 10%, and Steel Company of Canada with 10%.

Rich Silver Ore Struck At Vulcan

A SIDERITE VEIN showing high values in silver has been struck recently on American Smelting and Refining Co.'s leased Vulcan-Galena property west of Wallace, Ida. The vein, containing the first significant tetrahedrite ore found on the property, was encountered in a southerly crosscut from an east drift on the 3,000-ft. level about 800 ft. east of the Vulcan shaft. J. E. Berg, manager of the company's northwest mining department, said first channel samples gave 40 oz. of silver over a 4 to 5-ft. width. He said drifting would be started at once.

U. S. Firm To Help Korea Restore Tungsten Mines

SANDONG AND DALSUNG, South Korea's high-grade tungsten mines, will be restored and developed with technical assistance from the U. S., according to terms of a ROK-Utah Construction Co. agreement covering a five-year period. During that time, it's estimated Korean miners—working under American supervision—will produce $50-million worth of tungsten for delivery to the U. S. At the end of the period, the mines will be turned over to the Koreans.

Utah Construction, a San Francisco firm, is directed by one-time RFC Chairman Marriner S. Eccles, now chairman of the company's board of directors.

The agreement, signed after the U. S. Government contracted to purchase output of the mines for five years, provides for construction of a smelter and innovation of a new recovery process. The smelter will also be turned over to the ROK Government.

McCarthy Taking A Look At Peru

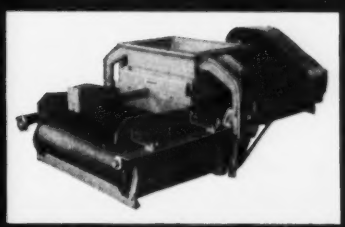
TEXAS OIL MAN Glenn H. McCarthy, with a $3-million investment contract in his pocket for exploitation of Bolivian sulphur, has been reported in Peru recently with several engineers and drillers. The *Peruvian Times* quoted him as saying in reply to a question whether he would undertake a mining enterprise there, "I'm just checking as yet. There's nothing definite."

Meantime, it's been reported output of McCarthy's Bolivian sulphur mine (*E&MJ*, November, 1952) will be paid initially to Brazil at $140 a ton. The concession in the department of Potosi, is in one of the world's most elevated mining fields, 1,960 ft. above sea level. The miners work only four hours a day in the cold air and strong winds. The sulphur is hauled by llamas to the camp, at an elevation almost as great as that of the mine, and there treated at a small melting plant.

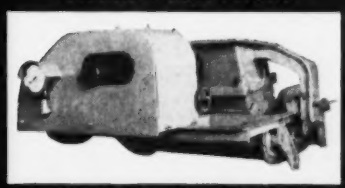
Recovery Pushed

AEC's long-range program to develop a technique for recovery of uranium from the hard, refractory shale of the Southeastern States has been stepped up by agreements under which Bureau of Mines will operate a small experimental mine near Sligo, Tenn., and M. D. Hassialis, head of Columbia's school of mines, will direct research for a better recovery process, at Columbia University. The Bureau brings to the endeavor its years of research and experiment with the softer, less refractory, oil-bearing shales of Colorado. The Columbia research team will work under a $550,000 AEC contract. The project is directed toward building an adequate domestic uranium ore reserve.

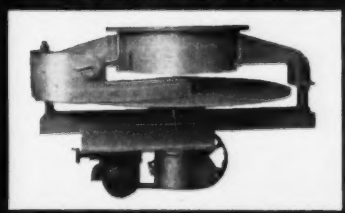
IF
FEEDING
IS YOUR
PROBLEM
THEN CHECK THESE
HARDINGE
FEEDERS



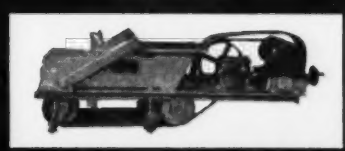
Constant-Weight Feeders



Weight-Recording Feeders



Disc Feeders



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CONSTANT-WEIGHT FEEDERS regulate the feeding of materials at a **constant-weight** rate, rather than a constant-volume rate. The feeder automatically compensates for changes in specific gravity and bulking, due to moisture, which would cause irregular feeding.

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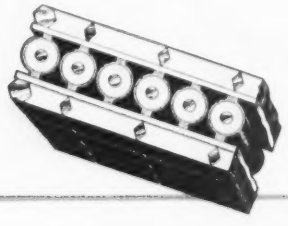
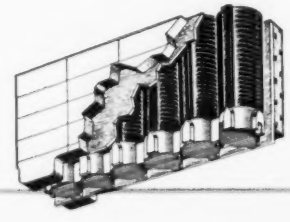
1888 . . . DEPENDABLE BATTERIES FOR 65 YEARS . . . 1953

Cross section shows relation of positive plate to separators and negative plate. Note the much greater exposure of active material to electrolyte as compared with that of the usual flat positive plate. This greater exposure makes possible the high power ability and uniform-voltage characteristics of the Exide-Ironclad. The negative plates have been made extra heavy to balance the increased capacity of the power tube positives.

Running through center of each tube is an alloy core which is cast with the heavy top cross bar. These form the sturdy, non-buckling grid. Both core and top bar are made of Exide's new corrosion-resistant Silvium, an alloy of silver, lead and other components, which adds greatly to plate's long life.

New polyethylene insulating tube sealer of acid-proof, non-corroding plastic fits snugly into bottom of slotted tubes and further reduces loss of active material. Thus more active material remains available, and the high battery capacity is maintained for a longer working life.





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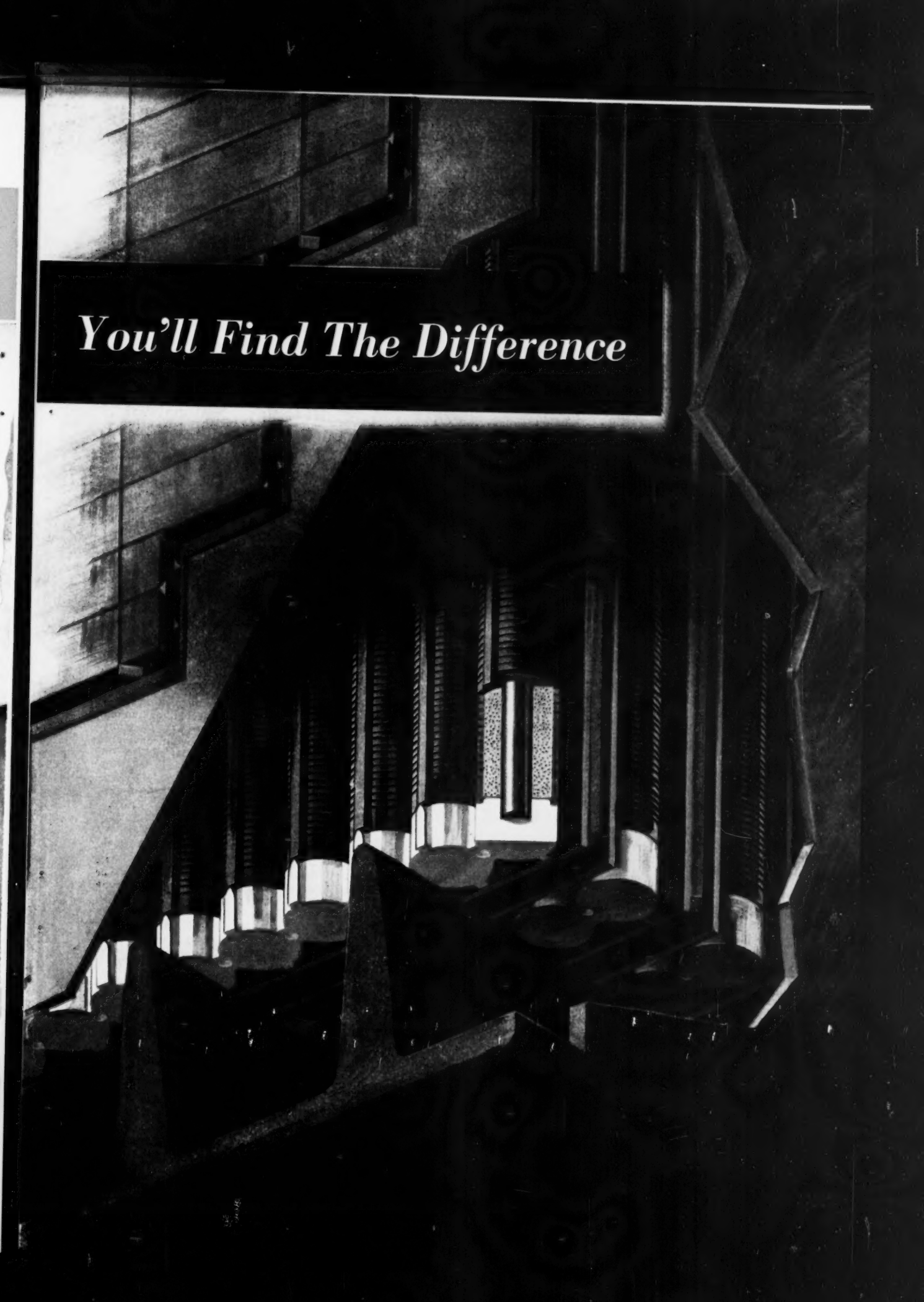
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BRANCH SALES AND SERVICE OFFICES

Bolivian Tin Program Gets Under Way

CONTRACTS SIGNED recently in Liverpool and Buenos Aires give substance to Bolivia's plans for operation of its nationalized tin industry for many years to come.

Williams, Harvey & Co., operating a tin smelter near Liverpool, England, has contracted to purchase concentrates of the entire output of the Patiño mines—Catavi, Huanuni, Cantillos, Viloco, Japó, and Colquechaca—about 50% of the country's total production. The Patiño group has been producing about 16,000 tons of tin contained in concentrates a year.

The smelter is controlled by Consolidated Tin Smelters, in which Patiño has an interest.

The contract is effective through 1955. Deliveries are to be made at the port of Mejillones in Chile.

More far-reaching is a government decree creating Instituto Industrial del Estaño Boliviano, with authority to administer a 10-billion-Boliviano smelter and a contract with Grupo Economico, Financiero, Industrial Y Comercial Salim-Chacur to build the smelter, plants to produce sulphuric and hydrochloric acids, a concentrating plant, and accessory bulidings and transportation facilities. Salim-Chacur's home offices are in Buenos Aires and Montevideo. (At the present New York bank exchange rate of $0.0045 per Boliviano, the cost of the smelter and accessory facilities would be $45-million.)

The decree sets up Fundición de Estaño de Bolivia, at La Paz, to purchase equipment, manage all facilities of the workers' community, and exercise for 25 years the exclusive right to concentrate, leach, smelt, and market all mine output from the Patiño group. Ultimate plant capacity is to be 50,000 tons a year—about half again as much as the country's annual tin production in recent years.

Manuel Barraú, named as president of the new Corporación Minera de Bolivia created to mastermind the nationalization of the mines, told a McGraw-Hill World News correspondent the site of the smelter would be near Oruro, a mining center about 120 mi. south of La Paz.

Commenting on the deal with the Liverpool smelter, one Bolivian Government official said Williams, Harvey demonstrated "great spirit of cooperation" that is notably in "contrast to the U. S. attitude."

RFC Buys Nationalized Tin from Bolivia

RFC has purchased approximately 5,000 long tons of tin contained in concentrates from Bolivia's nationalized tin mines. The base price is $1.17½ a pound, f.o.b. South American ports, the same as that agreed to in a short-term contract announced last September.

A joint statement by Harry A. McDonald, chairman of RFC, and Ambassador Victor Andrade said that the concentrates are from production during October, November and December and also include some production accumulated prior to that time. Andrade pointed out that the concentrates sold to RFC will include ore mined since the tin properties were nationalized on Oct. 31, 1952.

The problem of compensating American nationals whose holdings in Bolivia were nationalized are under discussion, he said. Also being considered between the United States and Bolivia, he reported, is a one-year contract for the sale of tin to the U. S.

Pershcourt Estimates Its Zinc-Silver Ore Near 10-Million Tons

PERSHCOURT GOLDFIELDS, LTD. (437 St. James St., W., Montreal 3) has taken out borings showing an estimated 9.573-million tons of zinc-silver ore with lead values and traces of other metals, including tin, in Barraute Twp., Abitibi County, Ontario. Roger Charbonneau, president, estimates that, on the assumption the ore zone is a continuous tabular body to a depth of 1,000 ft., the main zone contains 6.763-million tons grading 2.40% zinc and 2.17 oz. of silver and the footwall zone averages 3.45% zinc and 3.28 oz. of silver in 2.81-million tons of ore. The drilling program included 35 holes through a total 31,073 ft.

Charbonneau described the orebody as a sulphide zone in a belt of altered agglomerate breccia mineralized with pyrite, a very fine-grained sphalerite, and minor amounts of galena and freibergite (argentiferous tetrahedrite). Due to a 75% dip to the northeast, Pershcourt's probing has been moving on to the adjacent property of Barvue Mines, Ltd., at a horizontal rate of 50 ft. to each 100 ft. increased depth. The property measures 800 acres.

The shaft, composed of two hoisting compartments and a manway, is designed to handle up to 1,000 tons a day. It's now down 558 ft. Development includes two levels, at 300 and 400, crosscuts from both to the vein, and drifting both east and west from the crosscut on the 450.

Disappointing samples taken from the crosscut on the 300 Charbonneau attributed to a cross fault displacing the ore zone. He said two 10-ft. cores intersecting the footwall, west and east of the crosscut, showed 5.35% and 4.16% zinc, respectively, and 0.77 and 1.97 oz. of silver.

He said the average of muck samples taken along 338 ft. of the 450

indicated 4.54% zinc, 0.31 oz. of silver, and 0.44% lead and would have shown even better but for the fact that about 30% waste was included in samples from the east drift, where faulting was encountered. From this level, he reports, a parallel zone has been discovered in which three boreholes to west gave an average of 4.81% zinc and 1.52 oz. of silver over an average width of 33.8 ft. for a length of 75 ft. and two to the east averaged 8.1% zinc and 3.05 oz. of silver through 8.2 ft. average width and length of 50 ft. This part of the zone is still open both east and west.

Laboratory tests have indicated conditionally that Pershcourt could mill two concentrates, one for 97% recovery of zinc, the other for lead and 93% of the silver.

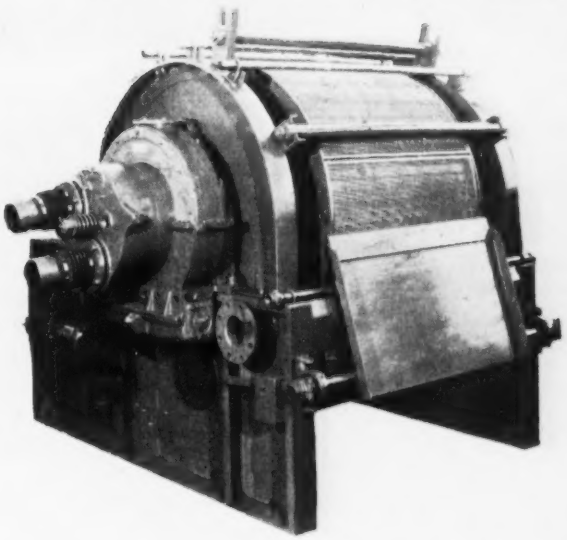
The plant includes offices and warehouse in a Quonset hut, a hoist and compressor building, a sub-station with transformers, a 30-ton-capacity powder magazine, and a 75-ft. timber headframe designed in such a way that it can be extended 25 ft. should the need arise. Equipment includes a C. I. R. 48x36-inch P. E. electric hoist, with both drums clutched and Simplex safety controls, having capacity to pull 11,000 lb. on 2,000 ft. of ⅞-inch rope at 750 ft. a minute; a C. I. R. Type XV, H compressor with 900 cfm capacity; two C. I. R. XVII, B. O. 2 compressors each having 450-cfm capacity; a 50-hp. low-pressure steam-heating plant, and 26 one-ton-capacity mine cars.

Anaconda Buys Out North Butte Mining

STOCKHOLDERS of North Butte Mining Co. authorized sale of all the company's mining assets to Anaconda Copper Mining Co. for $2-million. Included are the Granite Mountain, Speculator, Tuolumne, and Gem mines, all in Silver Bow County, Mont.; 99% of the stock of Butte Exemption Copper Co., which owns adjacent properties; and an 18.79% interest in Unity Gold Corp., which holds inactive claims in the Cripple Creek district of Teller County, Colo.

Faced with imminent foreclosure on a $425,000 RFC loan that was 6 months in default at the time of the sale, North Butte's directors recommended speedy action to preclude a forced sale and to minimize debt charges that were adding to the company's obligations at the rate of $2,500 a month. They attributed the company's losses —$92,542 in 1949, $94.332 in 1950, $282,380 in 1951, $181,600 last year— to inability to raise enough capital to operate on a commercially feasible scale and the low prices of zinc and copper. It was pointed out that Anaconda, with large capital resources and men and equipment already in the field working adjacent properties, was in a good position to operate the same properties profitably.

NEW VACUUM FILTERS FOR NEW PROCESSES



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Tours Feature Mining Congress "Down Under"

EVERY MAJOR MINING field and metallurgical plant in Australia is believed to be on the itineraries of three comprehensive tours of Australia scheduled as a feature of the Fifth Empire Mining and Metallurgical Congress April 20 to May 22. Delegates may select tours on the basis of their special interests—nonferrous mining and metallurgy, gold mining and metallurgy, or the iron and steel industry. In addition to the three tours during sessions, arrangements have been made for one-week tours of Tasmania before the Congress is convened and for two hours of New Zealand and the Fiji Islands after the Congress is adjourned, a five-day pleasure trip, and a 16-day survey of mine-industry facilities.

Highlight of the agenda is a reception to be given the delegates April 26 at Canberra by the Commonwealth Government.

Further information on the Congress and its official publications may be obtained by writing to S. E. Sweet, of C. Tennant, Sons & Co., 100 Park Ave., New York 17, N. Y., or I. H. Carne, of Broken Hill Proprietary Co., Ltd., same address in New York.

IN THE U. S.

ARIZONA

★**Arizona's $219,656,810 yield** of copper, silver, gold, lead and zinc in 1952 represented a 7% drop from 1951 despite a record output of copper ore.

This was caused by a decline in copper production—393,350 short tons, a 22,520 ton drop from 1951; a 2% drop in gold to 113,500 oz.; a 10% loss in silver to 4,605,000 oz.; a 7% drop in lead to 16,150 short tons; and a 13% loss in zinc to 46,000 short tons.

Total ore treated from Arizona mines in 1952 was 45,360,000 tons—a record and a 3% gain over total output in 1951.

Copper led the ore output with 44,525,000 tons.

★**Cypress Mining Co.**, with an option on the Copper Queen Mine in the Bagdad district, (Mike and Bill Lawler, Bagdad) has turned up some good drilling in development work on the zinc and copper orebody. A drift cutting surface workings is being extended, and good copper ore has been located in drill holes which cut the vein 200 ft. below the surface.

★**Arizona's Department of Minerals and Resources** has asked the legislature for a budget approval of $65,020 to provide for a director and three field engineers, a statistician, part time land and law specialist and office employees. The 1952-53 budget was $57,935.

FREE

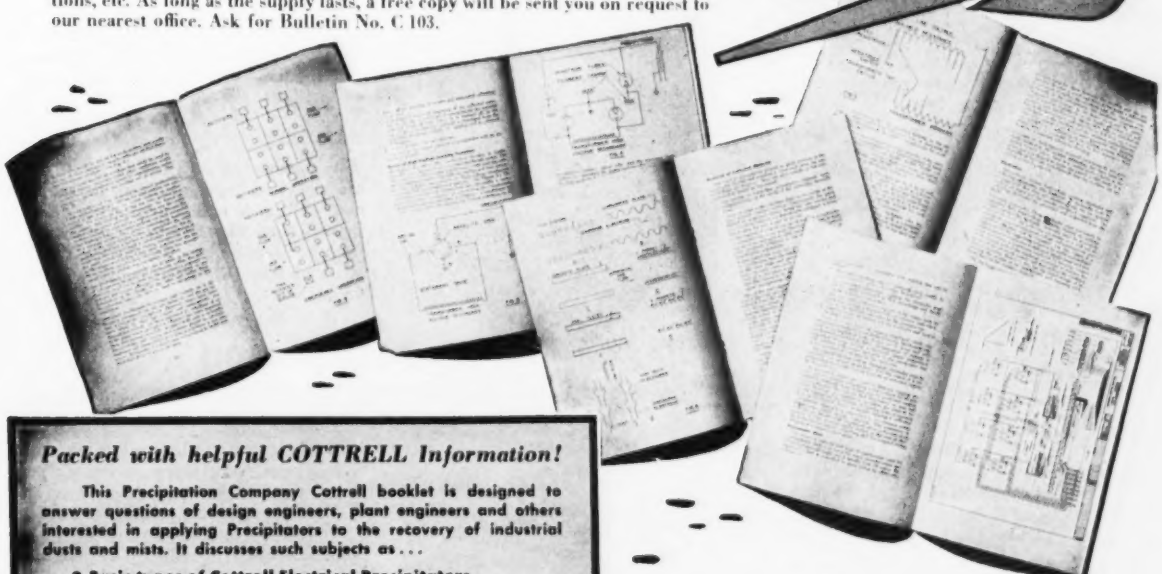
From Precipitation Company—the organization that pioneered the commercial application of Cottrell Precipitation...

IF YOU ARE ENGAGED in any phase of industry where the recovery of dusts, fumes, fly ash, mists, fogs or other suspensions from gases is a problem, you will find this booklet on the COTTRELL Electrical Precipitator helpful and informative.

Precipitation Company pioneered and installed the first commercial application of the well-known COTTRELL Electric Precipitator—Dr. Cottrell, the inventor, being a member of the company. And for more than 43 years Precipitation Company has consistently led in developing new COTTRELL advancements and techniques for recovering suspensions from gases, both wet and dry.

This free 28 page booklet summarizes many of the basic facts you should know about modern COTTRELL Precipitators—the various types available, how they operate, principal types of electrode systems and rectifiers, shell constructions, etc. As long as the supply lasts, a free copy will be sent you on request to our nearest office. Ask for Bulletin No. C 103.

28 PAGES
of helpful facts to know about
COTTRELL ELECTRICAL PRECIPITATORS



Packed with helpful COTTRELL Information!

This Precipitation Company Cottrell booklet is designed to answer questions of design engineers, plant engineers and others interested in applying Precipitators to the recovery of industrial dusts and mists. It discusses such subjects as...

- **Basic types of Cottrell Electrical Precipitators.**
- **Principal parts of a Cottrell Precipitator.**
- **Mechanical and Electronic Rectifiers.**
- **Various types of Collecting Electrodes (rod curtains, corrugated plates, dual plates, pocket electrodes, etc.).**
- **Removal of Collected Material.**
- **Factors in Shell Construction (steel, concrete, brick, etc.).**
- **Operating Efficiences and the Effect of Various Factors on Performance.**

... and many other basic Cottrell facts. Write for your free copy of Bulletin C103 today while supplies are adequate!

The above typical pages indicate the type of technical data and helpful illustrations contained in this booklet on COTTRELL Precipitators—data based on over 43 years of development work and first-hand engineering experience originating with the first commercial application of COTTRELL equipment.

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To haul 80 tons of strip-mined coal from pit to tipple, Hume-Sinclair Coal Mining Co., Hume, Mo., ordered a 40-ton tractor-trailer rig from Dart Truck Co. By building a Dart tractor and cab to specification—adding a semi-trailer bigger than a hopper car—and installing a Cummins 400 hp V-12 supercharged diesel engine and a Twin Disc Model CF Truck Type Torque Converter, Dart delivered the super-sized truck.

From the first, the big truck has pulled out of the pit and up the hill with its 80-ton payload—*in high gear*. The driver simply steps on the accelerator to automatically get up-to-6:1 torque multiplication—highest in the field—and keep 120-tons GVW *moving*. On the trip back down, with 40 tons of truck, the driver merely lets up on the accelerator to bring Twin Disc's exclusive Converter Braking feature into action; saving brakes, tires, driving train—*and* operator fatigue.

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Arizona (*Continued*)

★**Exploration work** has been started in redeveloping several Pinal County mines. H. C. Cassavant and E. N. Garlock are working the Red Top Mine, a lead property, and new explorations are being made at the Woodpecker and Ajax mines in the Mineral Hill district.

★**Thorium deposits** found by Frank L. Ray of Tempe and F. L. Gonia, Chicago, in the southwestern part of Pima County, are being studied by engineers of Brown & Assoc., New York. Ray reports the find contains uranium, samarskite, and monazite.

★**Withdrawal of hundreds of thousands of acres** of Yuma County land from exploration and development work and conversion into aerial gunnery range has brought a wave of protests. The area includes many gold, lead, and copper prospects.

★**Manganese mine operators** in northern Yuma and southern Mohave Counties are rushing work on long-idle properties to supply the new federal sampling plant and purchasing depot at Wenden. The plant will handle 400 tons of ore daily and has storage area for 400,000 tons of ore. Three crushers will supply samples for testing at Tucson and Salt Lake City offices of the USBM.

★**A permanent AEC office in Phoenix** has resulted from uranium finds made near Kingman in northern Mohave County and the flurry of exploration taking place near the old Chloride-Mineral Park districts north of Kingman.

COLORADO

★**Front Range Mines, Inc.** reports total shipments of $281,926.60 for 1952. Practically all production came from the Strong mine in the Cripple Creek district. Several good prospects in the lower levels of the mine will be developed during the current year. John Deerksen, 405 Burns Vault Bldg., Denver, heads this enterprise.

★A USGS party has been studying the geology east of Westcliffe from Ten Mile road to the Haputa ranch and from Ilse to near Mt. Tyndal to determine **relationship of thorium radioactivity to the surrounding rock.**

★At Grand Junction, AEC and **American Cyanamid Co.** jointly announced construction was under way on a pilot plant to demonstrate new and cheaper methods of extracting uranium from ore. Frank H. MacPherson, acting manager of the AEC's operation office there, said the plant was scheduled to be in operation March 1. Twenty-five engineers and technicians will staff it.

★The recent drop in base metal prices has forced **Bonita Mining & Development Co.**, at Silverton, to curtail operations at its Lead Carbonate

mine, using a smaller crew to mine the Mocking Bird vein. The company is continuing to make shipments of lead-zinc-gold ore to the custom mill **of Shenandoah Dives Mining Co.** H.P. Ehrlinger, of Silverton, is Bonita's vice president and also serves as general manager.

★Idarado Mining Co. has been granted a lease and option on the lead-zinc mines and 100-ton differential flotation mill of **Colorado Standard Lead Zinc Mines, Inc.**, on Henson Creek. Idarado, which will further explore the Ute and Ulay veins, is owned by **Newmont Mining Corp.** and **Homestake Mining Co.** Fred Wise of Ouray, is manager.

★Colorado mines produced $50-million worth of uranium last year, Walter E Scott, Jr., state commissioner of mines, estimated. Molybdenum topped the list of other metals, with production of $27-million. Scott's report showed a sharp increase in all other mineral output during the year 1952, as well.

★Merrill Shoup, president, said **Golden Cycle Corp.** will join an industry-wide movement of gold producers to sue for millions in damages they attribute to the Federal Government's closing of their mines during World War II. The claim is based on the contention the Government acted without due process.

★**Gold Chief Mines Co.**, operating the We-Got-Em claims in Silver Creek, near Central City, is developing the winze, drifts being extended both east and west. It is expected the mill, which is being put in condition, will soon be operating. Maude Russell is manager.

★**Gold receipts** hit a postwar high, and **silver receipts** reached an all-time high **at the Denver mint** last year. Officials said that 1952 receipts of gold, 805,918 oz., worth $28,207,121, were the highest since the $47.5-million total of 1942. The 1941 total was $69-million. Receipts of silver amounted to 2,459,674 oz., worth $2,225,018. The largest previous receipts came to $1.7-million, in 1933. The 1951 receipts of gold were 615,157 oz., worth $21,530,474; of silver, 764,408 oz., worth $691,546. Higher receipts were attributed by mint officials largely to expanded operations of **Kennecott Copper Corp.** in Utah. The mint's present stock of gold is worth about $6-billion.

★**American Smelting & Refining Co.** will build a 200-ton-a-day flotation mill at the Keystone minesite above Crested Butte, Nolan Probst, Keystone manager, has announced. He said construction would get under way "as soon as the snow leaves." Directors of Gunnison County Rural Electrification Association have voted to offer power for the operation. The power will be needed by next fall. To supply it, a new line from Gunnison is required.

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GEORGIA

★A $750,000 plant to be constructed at East Point, near Atlanta, by Tennessee Corp. will produce manganese sulphate and other salts. Dr. J. K. Plummer, who has been general manager of the corporation's operation at East Point since its inception in 1920, will head the new operation. A certificate for accelerated tax amortization has been granted.

IDAHO

★**An "interesting" zone of radioactive ore** has been found in Bunker Hill & Sullivan Mining and Concentrating Co.'s Crescent property on Big Creek, in the Coeur d'Alene mining district. The discovery was made by AEC representatives during the course of a scintillometer survey of recently-reopened upper workings of the property, which has been idle for more than 10 years.

The zone of radioactive ore was detected in the long creek-level adit tunnel, near the collar of the 1200-foot Crescent shaft. Extent or importance of the discovery has not yet been determined. The ore is said to be similar to the uranium ore found in 1949 on the 3100 and 3700-foot levels of the Sunshine mine, which adjoins the Crescent on the east.

Interesting feature of the new find is the fact that it appears to be in the same geological fault zone as the Sunshine discovery, but at a relatively-shallow depth, over 3000 ft. higher.

★**Sunshine Mining Co.** is setting new depth records in shaft-sinking operations now in progress. The No. 5 winze, some 2500 ft. southeast of the main Jewell shaft, is being deepened to provide 3850 and 4000-ft. levels which will be 1150 and 1300 ft. below sea-level, respectively. A station for the 3850 level has been cut, and sinking to the lower horizon is now under way. The Bunker Hill shaft is now the district's deepest. Its 27 level is approximately 1200 ft. below sea-level.

★**Bradley Mining Co.** has been granted a second antimony exploration loan contract by DMEA. The new contract provides for expenditure of an additional $53,000 on antimony exploration at the firm's Stibnite 7 property, which constitutes the nation's largest antimony reserve. A $97,368 project is already under way. The government advances 75% of the cost of the projects on a loan basis. For the past six months, work at the property has been concentrated on finding and determining the size of new orebodies. The company closed down its mining, milling and smelting operations last summer because it could not meet the competition of cheap foreign ores and metal. Limited smelting operations are to be resumed this spring on accumulated by-products and secondary materials now available at the prop-

erty. Later, foreign ores may be purchased for smelting, if market conditions are such that the company's directors believe this is warranted.

★**Calera Mining Co.**, the nation's only important producer of cobalt ore, has been forced to curtail operations at its Blackbird mine and mill in Lemhi County because refinery facilities for its concentrate products are not yet available. Howe Sound Co., parent firm, is reported to have encountered some technical problems in getting its new $2,500,000 cobalt refinery at Garfield, Utah, into production. The new facility was slated to begin operations last July, using a new leaching and precipitation process developed by Chemical Construction Company of New York. With sufficient concentrates already stockpiled to keep the refinery supplied until it gets into full production, Calera will operate for the time being on a limited scale.

★**Mining operations in northern Idaho** were able to resume normal full production and development schedules in mid-January when the Defense Electric Power Administration suspended the 10% cutback in power usage which had been imposed on November 17. Unseasonably mild weather and heavy rains throughout the Northwest built up the water supply behind power-producing dams, cutting short a power pinch which, with normal weather conditions, would have continued until late March. A week after firm power was restored, interruptible supplies which had been cut off last September were also restored, enabling Sullivan Mining company to resume capacity operations at its electrolytic zinc plant at Kellogg. It was the only plant in the Coeur d'Alene district which depended upon interruptible power for full production.

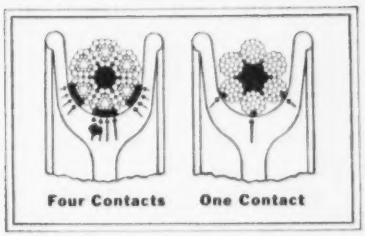
★**One of the longest ore shoots ever found** in the Coeur d'Alene mining district has been opened on the 2000-ft. level of Lucky Friday Silver-Lead Mines Co.'s property east of Mullan. The development drift on this level shows continuous ore for more than 900 ft. One stope west of the crosscut from the shaft is being mined over a width of 16 ft.

Latest shipment of concentrates by the company, totaling 27 cars of lead and three cars of zinc, brought over $340,000 in smelter returns. About 13,-520 tons of ore were milled at the Golconda Lead Mines' concentrator to make up the shipment. The ore averaged about 7½% lead, 14 oz. silver and a little more than 1% zinc per ton. Another mill-run of several thousand tons is now in progress.

Work on a new and larger shaft for the operation is under way. A full three-compartment shaft raise is being run from the 2000 to the 1800 level, and when this is completed a vertical winze directly under it will be sunk to open a new 2200 level. The shaft raise will eventually be extended all the way to the main adit level of the mine.

Engineer answers vital questions about the strongest wire rope made—Flattened Strand

Why does Hercules® Flattened Strand wire rope continue to outperform round strand rope by 2 to 1 or more? Can you use it? Here, Walter C. Richards, chief engineer, A. Leschen & Sons Rope Co., tells you.



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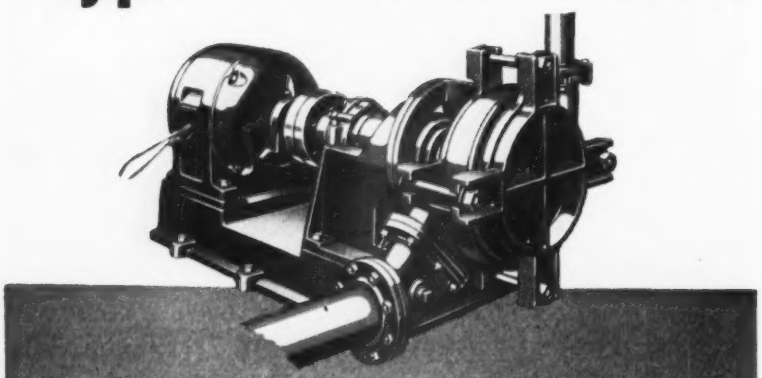

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ILLINOIS

★Walter S. Skeels, **Alcoa Mining Co.** works manager, announced work is now under way to put the company's Eagle-Babb fluorspar mine, in Livingston County, north of Salem (Ky.), into operation in less than a year. The present 300-ft. shaft will be extended 200 ft. Ore is to be trucked to the company's Rosiclare mill.

★About 70 employees of **Alcoa's** Hutson mine, in Livingston County, southeast of Salem (Ky.) were transferred to the company's Eagle-Babb and other fluorspar operations in the Kentucky district when the market decline drove Alcoa to suspend zinc ore production at the Hutson and put it in stand-by condition.

★New address of executive offices of **Calumet & Hecla, Inc.** (*E&MJ*, March issue) is the 20th floor, People's Gas Bldg., 122 S. Michigan Ave., Chicago.

MICHIGAN

★A man was instantly killed at the Peterson mine at Bessemer when he looked into the cage compartment and **his head was caught between a divider and skip.** This is a type of accident that has occurred many times during the years.

★Nearly 80 supervisors at **Republic Steel Corp.** iron mines will attend a school of basic economics this winter. Men from the Susquehanna, Stevenson, and St. Paul-Day mines on the Mesabi Range; the Penokee, at Ironwood, on the Gogebic Range; the Tobin, at Crystal Falls, on the Menominee, and the Duluth (Minn.) district office will attend. The course, consisting of fifteen 90-minute sessions, was developed jointly by the University of Chicago's Industrial Relations Center and Republic.

★Inland Steel Co. shipped 386,525 tons from its Morris and Greenwood mines on the Marquette Range and 633,366 tons from the Menominee Range Sherwood and Bristol mines. Total Michigan shipments were 1,019,891 tons.

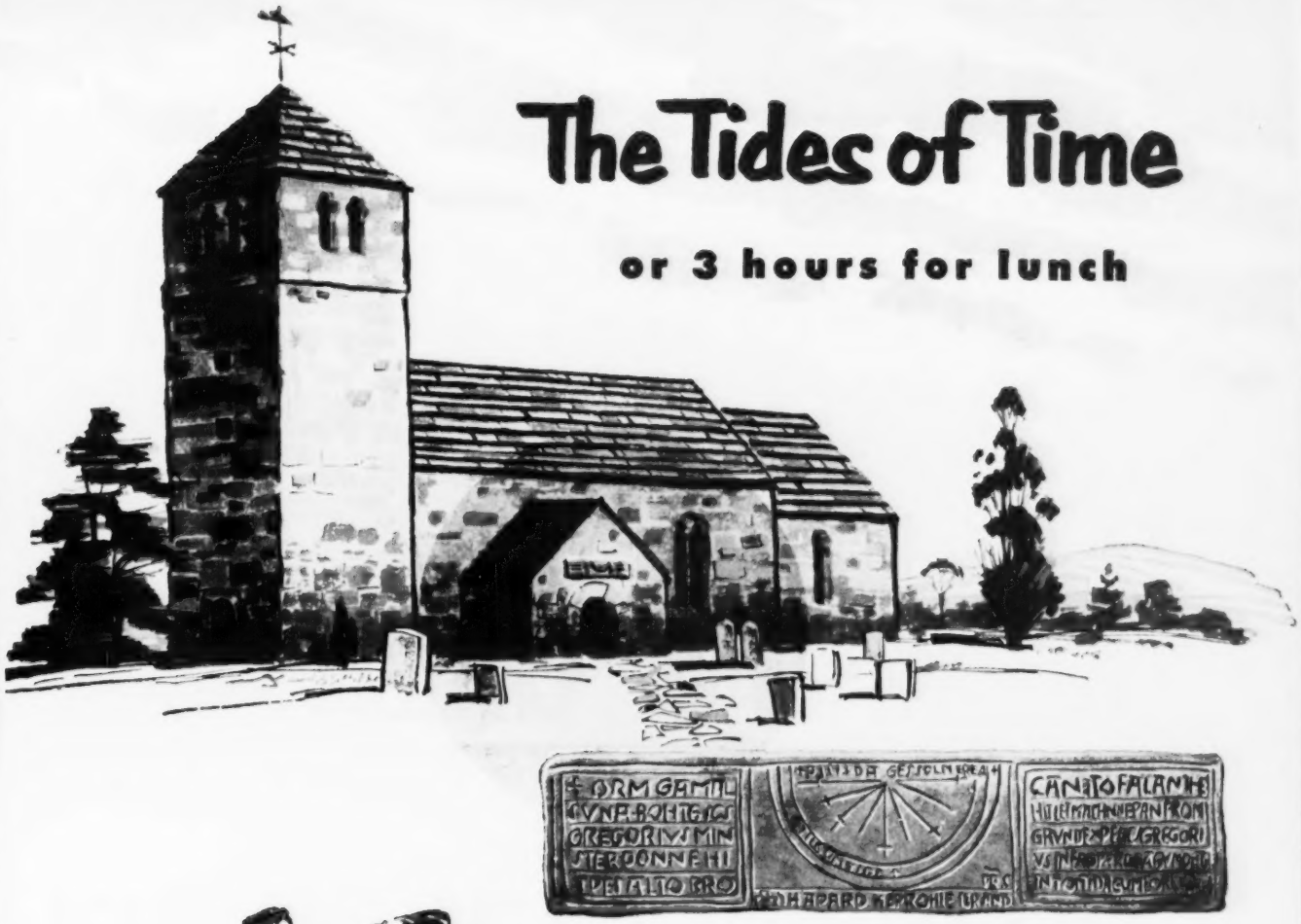
MINNESOTA

★Biwabik, on the eastern Mesabi Range, is stimulated by **taconite concentration developments.** A new bank has been opened to replace the one which closed in 1927. The Modern Home Manufacturing Corp. has been formed, with a 260 x 160-ft. plant, and more than 15 of its homes have been erected in the East Addition. The plant turns out about five homes a week. A new concrete-block plant also has been built during the last year, about 2 mi. south of Biwabik.

★At the annual election of the **Minnesota section, AIME,** in Duluth, Lloyd

The Tides of Time

or 3 hours for lunch



On this sundial on the south wall of a thousand-year-old Saxon church in Yorkshire, the day is divided into eight "Tides" of three hours each. Morgan-tide (morning-tide) is from 4:30 to 7:30 a.m.; Daeg-mael (first-tide is 7:30 to 10:30 a.m., and Mid-daeg (midday or noon-tide) is thoughtfully extended from 10:30 a.m. to 1:30 p.m.—evidently the origin of the three-hours-for-lunch idea. Measuring time in three-hour segments was probably adequate in those days when the most complex machine was the windmill, but today time is so valuable that it is one of the highest priced components in many of our projects. To get the most out of valuable drilling time, we suggest that you use Truco Diamond Bits. Their irresistible cutting power penetrates any formation, swiftly, accurately, thriftily, dependably. They are used profitably in every phase of drilling. May we send you our Diamond Bit Catalog?

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★ impact of the important worldwide metal and nonmetallic mineral industry expansion programs

★ impact of important individual company expansion programs – Not Only On Your Industry and Its Future But – More Important – On You and Your Future

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in July, 1953

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NONMETALLICS. Details of the growing nonmetallics field, highlighted by the new projects in potash, sulphur and phosphate rock.

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AN AUTHORITATIVE ANALYSIS of the outlook over the next few years for the big production minerals—aluminum, iron ore, copper, lead, zinc and potash.

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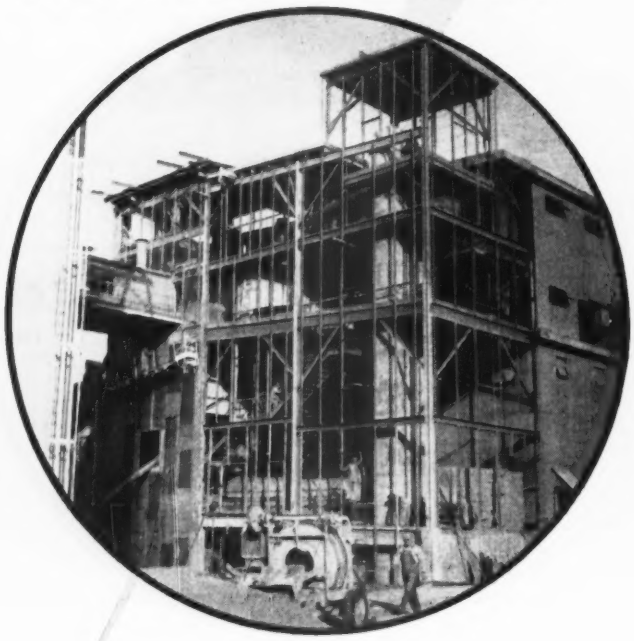

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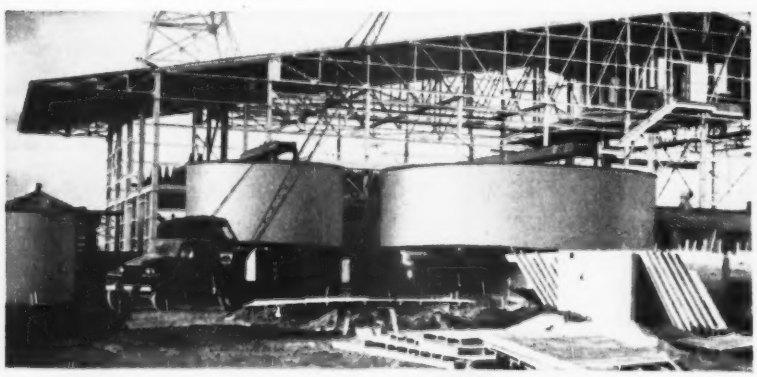

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Minnesota *(Continued)*

J. Severson, Duluth, general mining engineer for the Oliver Iron Mining Division, was chosen chairman for 1953, to succeed Hugh Leach, of Marble. J. L. McEachin, Duluth; Eugene P. Pfleider, Minneapolis; and Fred D. Devaney, Hibbing, were elected vice chairmen, and Everett L. Joppa, Duluth, secretary-treasurer. A resolution supporting Ted B. Counselman for national chairman was submitted by Grover J. Holt and unanimously adopted.

★**Steep Rock Iron Mines, Ltd.**, shipped 1,274,666 tons in 1952, only 52,058 tons less than in its record year, 1951.

M. A. Hanna Co. shipped 8,262,677 tons from 35 units on the Mesabi Range in 1952. The Bray mine at Keewatin heads the list, with 722,824 tons; the South Agnew had 693,058 tons, and the Mesabi Chief, 495,129 tons. Spring Valley shipped 477,546 tons all-rail. With 1,060,496 tons from the Cuyuna Range, where the Portsmouth mine was first, with 393,862 tons, the M. A. Hanna total Minnesota shipment was 11,668,627 tons.

★A bill introduced recently in the legislature would **increase taxes on iron ore** by $5-million per year, somewhat more than the governor recommended.

★**Inland Steel Co.** shipped 481,750 tons of ore from Minnesota mines, Armour Nos. 1 and 2 on the Cuyuna Range, in the 1952 season.

MONTANA

TED E. COLLINS—new president of Mining Association of Montana.

★The 10th biennial legislative meeting, **Mining Association of Montana**, named Ted E. Collins, of Helena, Mont., head of Collins Land Co. and trustee for Marysville Gold Mining Co., to succeed L. B. Manning, of Philipsburg, general manager of

Trout Mining Division, American Machine & Metals, Inc., as its president. Manning was elected member at large of the executive committee. Fred E. Burnet, of Garrison, superintendent of Montana Phosphate Products Co., was elected first vice president; Charles S. Burriss, of Trident, plant manager of Ideal Cement Co., was elected second vice president; and Carl J. Trauerman, of Butte, was re-elected secretary-treasurer.

Speakers were Mayor J. R. Kaiserman, of Helena; Dr. J. R. Van Pelt, of Butte, president of Montana School of Mines; Henry A. Yaeger, of Helena, state supervisor of apprenticeship, U. S. Department of Labor; and W. S. March, Jr., of Butte, a faculty member of Montana School of Mines.

The principal resolution adopted was as follows:

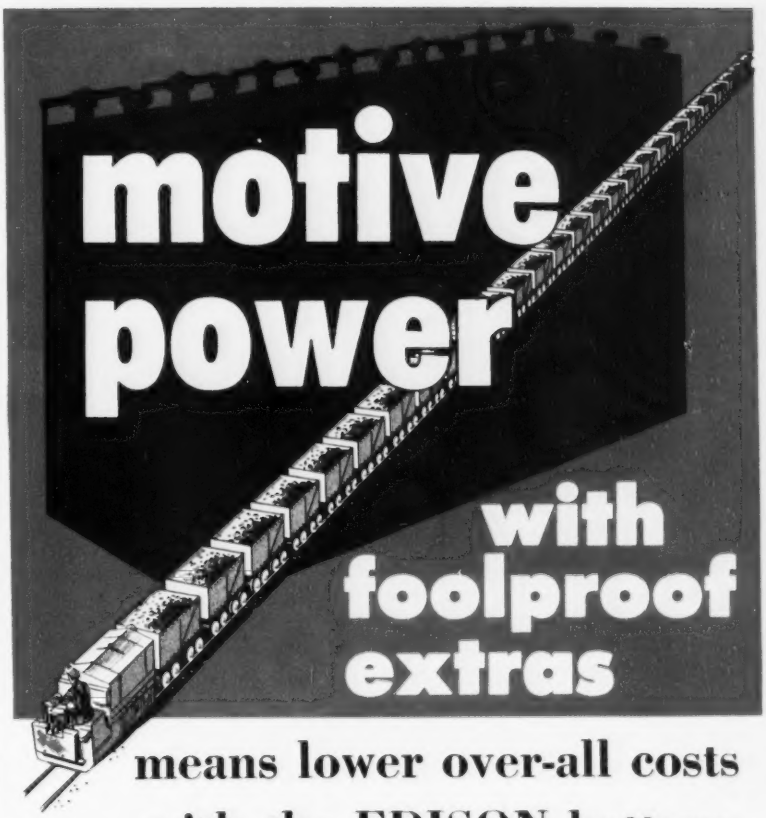
> Since October, 1942, the production of gold in Montana has been seriously retarded, and most of its several hundred gold mines have ceased operation. This is initially due to the shutdown order, L-208, imposed by the U. S. Government during World War II. When the shutdown order was rescinded in 1945, most of the gold mine operators found they could not produce, owing to increased costs and the fixed price of gold at $35 per oz. established by the U. S. Government. In a number of foreign countries gold is now selling at prices far higher than $35 per oz.
>
> Therefore, we urge the 33rd Montana legislative assembly to adopt a resolution or memorial addressed to the President and Congress of the U. S. A. requesting that Congress appoint a committee consisting of members of both houses of Congress, gold miners, and economists to study the present appalling situation in the gold-mining industry of the U. S. and to make recommendations to revive that industry on a businesslike basis.

★According to announcement from Grand Junction (Colo.) **Minerals Engineering Co.** (Blair Burwell, of Grand Junction, president) will construct a tungsten-ore concentration plant near Glen, Beaverhead county (Montana) and a refining plant at Salt Lake City. Minerals Engineering and **American Alloy Metals, Inc.**, are developing large deposits of low-grade tungsten ore that contains molybdenum, in the Brown's Lake and Birch Creek districts, west of Glen and south of Butte.

★**A lead-zinc deposit** of considerable importance has been uncovered on the North Boulder property, an 18-claim group eight miles west of Basin, built up by Albert F. Carlson of Basin around a nucleus of three patented gold claims. Carlson started exploring the property in 1948. Further development with the assistance of the Bureau of Mines enabled the owner to get a $25,000 exploration loan contract from the DMEA. Work to date indicates a main ore-bearing structure about 60 ft. wide and 2800 ft. long. One area entirely stripped of overburden shows vein material 100 ft. long and 60 ft. wide.

NEVADA

★**Black Rock Desert Mineral Co.** is now producing 400 tons of agricultural grade sulphur daily at its mill and



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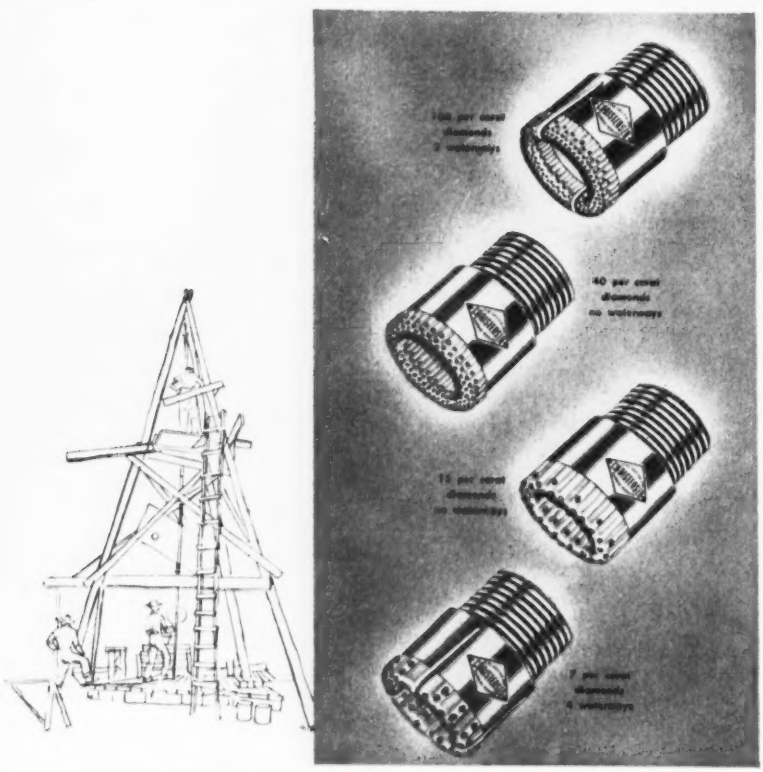
MANGANESE ORES

IRON ORES



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Nevada *(Continued)*

refining plant in the Devil's Corral area 3 mi. from the Western Pacific Railroad. The property covers 110 acres and is credited with approximately 5,000,000 tons of commercial-grade sulphur.

★**Government loan of $750,000** has been granted the Eureka Corp. Ltd. for its $3 million program at the firm's Ruby Hill property near Eureka. After getting the loan, a draw-down test was started under direction of General Manager George Mitchell to determine the number of gallons that will have to be pumped in order to permit mining at the 2250-ft. level. The test was supervised by Wilbur T. Stewart of the ground water division of the U. S. Geological Survey. The Eureka Corp. at the same time continued its rotary drilling program and presently is employing 75 men. Ventures, Ltd., has an interest in Eureka.

NEW JERSEY

★The Franklin and Sterling Hill mines in Sussex County were operated continuously during 1952, but the state's **zinc output was 7% below that for the year previous** in spite of the absence of any interruption in output.

NEW MEXICO

★**Freeport Sulphur Co.** has been prospecting extensively over an area 9 mi. east of present mining activities and about 30 mi. from Carlsbad. The company expects to conclude this program in June and have sufficient information at that time concerning reserves and other matters on which to base a decision later in the year as to whether to develop the property. This news is published in correction of an item that appeared in the January issue, *E&MJ*, which erroneously stated that Freeport Sulphur had already decided to mine potash at the site.

★**The area of Uranium exploration was enlarged** late in January when the Zuni Indian tribe approved a permit to Walter Graves, of Aztec, N. M., to prospect 7,000 acres of tribal land. The tract is about 30 mi. south of Gallup. Uranium mining is already in full swing on the Navajo and Laguna reservations, farther along to the north and east.

★**The Navajo Indian tribal council** has received a tentative proposal through its mining engineer, K. N. Garard, of Window Rock, Ariz., which might lead to a $4 million plant near Crystal, N. M. Climax Molybdenum Co., Garard said, has plans for the plant to process low grade manganese ores on Indian lands if market conditions are favorable and if the WPB will guarantee a firm price for manganese for at least 10 years.

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NEW YORK

★**Jones and Laughlin's** New York Ore Division after two years' preparation was ready to produce from martite (nonmagnetic) ore, in increasing ratio to its output from magnetic ore, and increase overall production from the Benson mines at Star Lake. Construction work included erection of new martite and sinter plants, an office building, a core-storage building, a bit shop, additions to the garage, a new truck approach to the primary crusher in the pit, a road for trucks between plant and pit, and relocation of power lines. A considerable diamond-drilling program and extension of the pit outline were carried on at the same time.

★The 2½-month strike last summer at **St. Joseph Lead Co.'s** Balmat silver-lead-zinc mine and Edwards zinc mine, both in Lawrence County, accounts substantially for 28, 20, and 18% declines in 1952, from the year previous, in the state's production of lead, zinc, and silver, respectively.

NORTH CAROLINA

★Staffed by some employees who returned to work a few days after a strike was called and new recruits, **Tungsten Mining Corp.** was able to report operation of its Henderson mine was returning to normal, but a jurisdictional dispute between rival unions was by no mean settled as this issue was put to press.

The strike was called Jan. 9 after two miners were discharged for alleged violation of underground safety regulations. The company and the Stone Workers Union (CIO) signed a contract granting a 12½% wage boost and fringe benefits, effective Jan. 15, and the company resumed operations the following day on a limited scale. Lucian L. Wood, representing District 50 (UMW), contended 300 of the mine's 420 employees already had notified the company of a preference for the UMW. He refused to recognize any new contract with the CIO union. NLRB on Jan. 26 filed a suit in U. S. District Court at Raleigh asking that a court order be delivered on the UMW local requiring its officers to show cause why they should not be restrained from continued use of alleged coercion in efforts to recruit CIO members to UMW ranks. NLRB charged UMW with using threats and picket lines to influence the company's employees.

U. S. District Judge Don Gilliam signed an order Feb. 3 requiring the UMW local to call off the strike and notify its members it was withdrawing the demand it be recognized as bargaining agent.

★GSA reported its **mica purchasing depot** at Spruce Pine in its first six months' operation paid $609,069 for 40,706 lb. of mica, most of it coming from Mitchell, Avery, and Yancey Counties.

OREGON

★**Hanna Coal & Ore Corp.** and the Hanna Smelting Co., subsidiaries of the M. A. Hanna Co., Cleveland, Ohio, have agreed to try to produce between 95 and 125 million lb. of nickel from the Nickel Mountain deposit in Douglas County. Hanna Coal & Ore Corp. is to develop the mine at its own expense, estimated at $4,300,000. The price will be $6 a dry ton for 1.5% nickel content, the average indicated by test drilling.

★**According to M. E. Volin,** division chief of the U. S. Bureau of Mines, Region II, who reported on the 129 properties examined in the Northwest in 1952, initial results of a reconnaissance survey indicated that western Josephine and eastern Curry Counties may prove to be one of the state's most highly mineralized regions.

★**Gold mining in Oregon,** once the primary mineral product of the state, was at an all time low during 1952. Value was estimated at $188,000, of which 90% was accounted for by placer operation. Most of this was done at the Powder River Dredging Co. operation in Sumpter Valley, Baker County.

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PENNSYLVANIA

★Silver, copper, and gold production for 1952 dropped 33, 32, and 30%, respectively, compared to 1951 output, on account of the steel strike and shutdown of **Bethlehem Steel Co.'s** Cornwall iron mine in Lebanon County, where copper and the noble metals are recovered as by-products.

New Jersey Zinc Co. continued to develop its **Friedensville** zinc mine in **Lehigh County**, but the state produced no zinc during 1952.

UTAH

★**Minerals Engineering Co.** of Grand Junction, Colo. has announced plans for a tungsten refinery at Salt Lake City to be built at a cost of some $700,000. It would be "most modern in type" and would handle ores from Montana and Nevada as well as a Utah stockpile, according to company executive Blair Burwell.

Linked to the plan is the Eimco Corp. of Salt Lake City, mining machinery manufacturers, which has sold a 12-acre tract on the Jordan River to Minerals Engineering for the proposed plant.

Joseph Rosenblatt, Eimco president, explained that the refinery would first treat some 30,000 tons of tungsten concentrates acquired by his firm after World War II, when purchasing a defunct processing plant.

Minerals Engineering is reported seeking aid from the Reconstruction Finance Corp. in setting up the Salt Lake operation.

The firm also plans erection of a $225,000 tungsten ore concentrator at Glen, Mont. Concentrates would be shipped from the Montana operation to Salt Lake City, and the end product of the Utah plant would be a pure tungstic oxide.

★**Naildriver Mining Co.**, an affiliate of Park Utah Consolidated Mines Co., has resumed work on a DMEA program in the firm's mines at Park City. The exploration project seeks new sources of lead-silver-zinc ores.

★**Directors of Silver King Coalition Mines** and Park Utah Consolidated Mines Co. approved Jan. 27 proposals to merge into a new company yet to be formed.

James Ivers, president of Silver King, and Lawrence Fox, president of Park, Utah, made the announcement of the action. The firms are among the largest in the Park City district, although both have been shut down since mid-1952, largely due to the decline in lead-zinc prices.

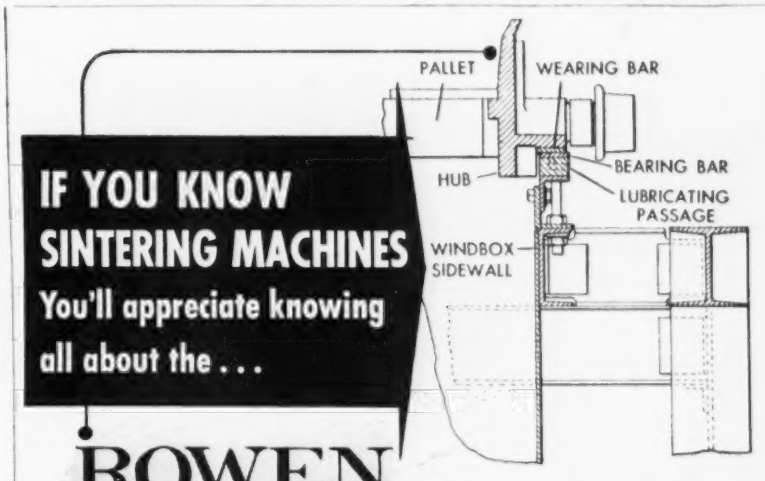
The consolidated firm—if the merger goes through—would own an estimated 8,700 acres of contiguous, patented mining claims in the heart of the district.

Tentatively each board has agreed the consolidation would be achieved by formation of a new corporation, capitalized for 6 million shares of $1 par stock. Present Silver King stockholders of record would receive 1.25 shares of the new consolidated firm, and Park Utah stockholders would get 1.1 shares of the consolidated company for each share presently held. All unissued stock would be held in the new concern's treasury, according to the plan currently favored.

★A new industrial development department has been established by the United States Smelting, Refining and Mining Co., according to W. C. Page, vice president and general manager of western operations in Salt Lake City.

The new unit is to be headed by J. M. Ehrhorn, previously assistant to the manager of the company's western mines. Boris Ashurkoff, formerly mechanical superintendent of U.S.S.R. &M. gold dredging operations in Alaska, will be production development chief. R. A. Pallanch, formerly mill superintendent at Midvale, and consulting metallurgist since July, 1952, will likewise be associated with the new department.

The new unit is to study, investigate and assist in the development of more efficient applications of present operating methods and the adaptation of new methods to company operations in both mining and processing of ores. The new department, according to Mr. Page, will likewise undertake economic and operating studies of any proposed



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Utah *(Continued)*

new operations or plans that may come up for consideration.

VERMONT

★**Vermont Copper Co.'s** Elizabeth mine and 500-ton flotation mill in Orange County in 1952 upped output of recoverable silver almost 14% above the corresponding 1951 figure, while producing about the same volume of gold and copper turned out in 1951. Concentrates were shipped to the **Phelps-Dodge Corp.** smelter and refinery at Laurel Hill, N.Y.

VIRGINIA

★Continuous operation in 1952—in contrast to the year previous, when a 6-month strike whittled down production figures—is reflected in annual increases of 159 and 78%, respectively, for lead and zinc output of **New Jersey Zinc Co.'s** Austinville mine in Wythe County. Ore was milled at the 2,000-ton-a-day plant at the minesite, zinc concentrate going to smelters at Palmerton, Pa., and Depue, Ill., and lead concentrate being treated at the Alton, Ill., smelter. The Austinville mill was also scheduled to handle ore from the company's Ivanhoe zinc-lead property.

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WASHINGTON

★**Columbia Lead & Zinc Mining Co.,** the only remaining small company with large holdings in the Metaline district, is planning to start a $26,000 diamond drilling program on its 500-acre property as early as weather permits. Geophysical methods have indicated two structures about 2,000 and 3,000 ft. in length, which will be drilled from the surface. During 1952, hand stripping showed two stringers of lead ore believed to be offshoots from the structures. Other surface exploration included eight test holes drilled by hand 20 ft. in exposed limestone on eight different claims. Mineralization of 0.9 to 1.9% combined lead and zinc showed in seven of the holes while the eighth showed 0.7% metal.

★**Henry T. Born,** president of Spokane Mining Syndicate, Inc., reports that the 111 north stub drift is in about 40 ft. of good ore, and mining will soon be on a two-shift basis in the Talisman mine. Walter A. Richelsen is in charge.

★**A chemical method of cementing soils,** used successfully in Germany, England and the eastern United States, is being introduced to Northwest's mining industry. The chemical solution is made by introducing metallic salts into water glass. When it is forced into the soil by pressure pumps through injection rods or drill holes, it both stabilizes the soil and stops water flow.

★**Preliminary annual reports** of the U. S. Bureau of Mines' Region II statistics branch at Alban, Oregon, showed that in spite of declining prices and a power curtailment late in 1952, production of both lead and zinc in the State of Washington made record gains during the year. Lead production, valued at $3,640,320, was up 42% to 11,376 short tons, compared with the previous high in 1950 of 10,334 short tons. Zinc, which was valued at $6,319,170, was up 5% or 19,149 short tons compared with the previous high in 1951, reported to be 18,189 short tons.

★**Kaiser Aluminum & Chemical Corp.'s** Mead reduction plant operations were reported to be "back to normal" at the end of January when the eighth and final potline was activated after almost five months of power shortage. Production cutbacks due to lack of power caused a loss of 50-million lb. of aluminum production and also caused serious unemployment.

★**At Pacific Northwest Alloys' magnesium plant** at Mead, 200 of the 800 employees laid off because of the power shortage had been rehired at the end of January, with one ferrosilicon furnace in operation, another to be started the first week in February and the other two to follow soon.

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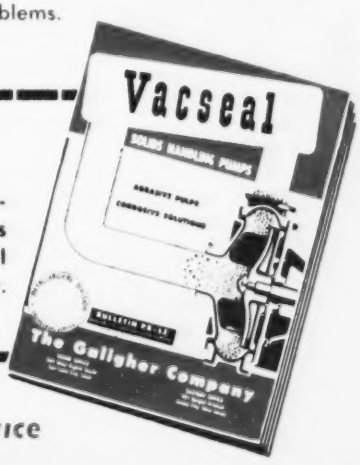

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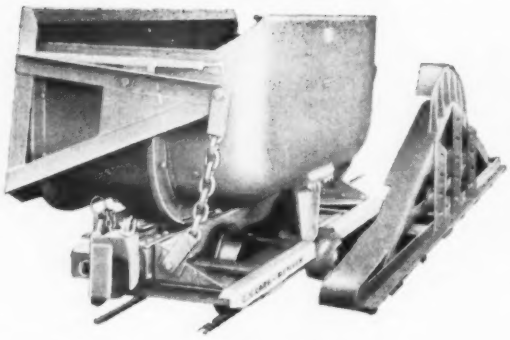

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IN ALASKA

★**A pioneer company** in geophysical prospecting methods credited with outstanding discoveries in Sweden, Canada and other countries, may bring its airborne equipment to southeastern Alaska this summer to make surveys of a region which is of interest to the company. It is said they may be asked to conduct surveys for other mining groups.

IN CANADA

ALBERTA

★G. E. Cherry, secretary-treasurer of **Beta Gamma Mines, Ltd.** (Gariepy Block, Edmonton) reports the company's No. 1 vein in the Beaverlodge uranium field has already shown enough values to justify sinking a shaft and that preliminary survey of a second vein indicates it may be commercially superior to the first. Both are on a 12-claim tract along a fault zone on Hammond Lake, just north and east of property of Rix Athabasca Uranium Mines, Ltd. Massive pitchblende appears on the surface of the second vein, which runs parallel to and about 350 ft. northwest of the end of the first. It's been traced to a length of about 1,100 ft. The company planned to drill the second vein at close intervals, but the sludge ran out, because of fragmentation and caving of the holes drilled, and it was not possible to assay the vein in this manner. However, geiger counts ran high—some so high the miners were unable to count them—and the company decided to sink pits at 100 ft. intervals. That work is in progress now.

BRITISH COLUMBIA

★Special tax concessions to encourage development of mines were urged by Frank E. Woodside, manager of the British Columbia & Yukon Chamber of Mines, at the chamber's 40th annual meeting in Vancouver. In an apparent indirect reply to recent reports that British Columbia's new Social Credit government planned to raise more revenue from taxes on natural resources:

"From the taxation standpoint, the mining industry should be considered in a category all its own," said Woodside. "It is a simple matter for some inexperienced persons to point to the most profitable mines in Canada and state that the mining industry should pay more taxes. To these people I wish to point out that metals are a hidden wealth, buried deep below the surface of the earth. Mining is a gamble and there is very little reclaim

value for the company that has spent millions on exploration work but has failed to locate pay ore."

★**Estella Mines Ltd.**, operating near Wasa, East Kootenay, is negotiating for purchase of a second property reported to be the Little Gem near Gun Lake, in the Bridge River area. The property has indicated high values in dollars, uranium and cobalt over mining widths.

★**Cariboo Gold Quartz Mining Co.**, operating at Wells, reports U. S. and Canadian investors have agreed to buy 250,000 treasury shares at $1.08 to enable Cariboo to continue a development program to increase ore reserves in a "gamble" that the price of gold will be increased from $35 per oz. U. S.

★**IUMMS delegates** decided to seek a shorter work week to combat layoffs in the mining industry. Discussion with management at a local level to shorten the shift week to four days to spread work among a greater number in event of layoffs was recommended.

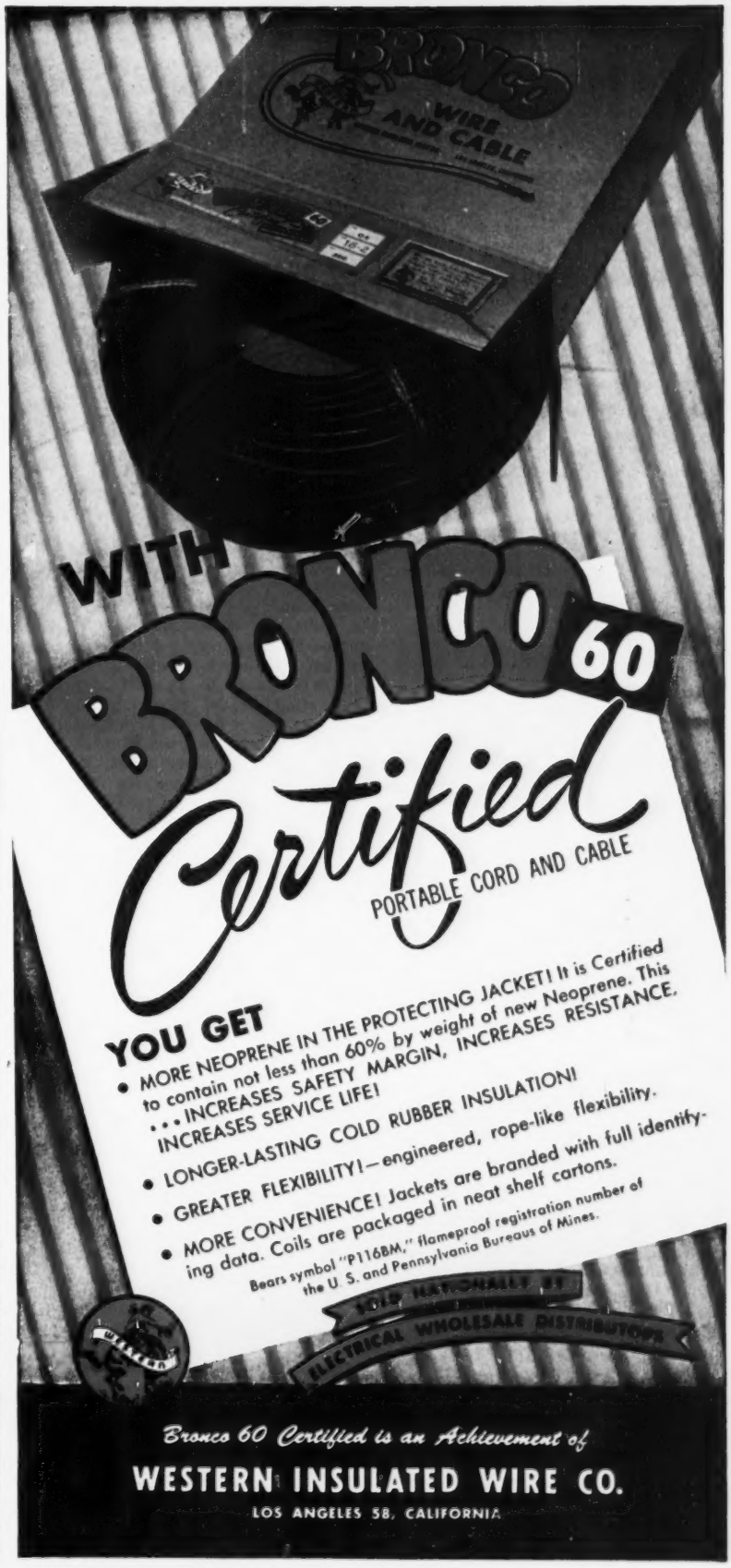
★**The Provincial Government** has issued a new ruling by order-in-council, for metal mines on the "short change" in shifts, in which workmen change from one working shift to another within 24 hours. The new regulations provide that, under existing agreements, the short change can be worked in above-ground operations or in smelters not more than once in 28 days and not sooner than 14 days after the last short change shift. When present agreements expire, the short change will be the subject of negotiation, but any agreement must be approved by Mines Minister Robert Sommers. The new order was issued following a conference between Sommers and Harvey Murphy, regional director IUMMS.

★**Consolidated Mining & Smelting Co.** at Trail has re-employed 100 of 120 men laid off last October because of a power shortage due to lack of water in the Kootenay district.

★**Doreen Mines Ltd.** is the latest company to enter the British Columbia asbestos field with a base metal mine near Hazelton and eight claims on McDame Mountain, in northern British Columbia, adjoining the property of Cassiar Asbestos Co., eastern Canadian firm. The company plans a drilling program to 1,000 ft. depth.

★**Cassiar Asbestos** is now shipping asbestos from its McDame property and plans to mill at a rate of 150 tons daily by July, and at 500 tons daily a year later. Present operations are based on diesel power, but company officials are studying possibility of a hydro site within 7 miles of the mine which could provide a minimum of 1,500 kw.

★**Western Asbestos & Development Co.** plans to convert from a private to a public company, raise more money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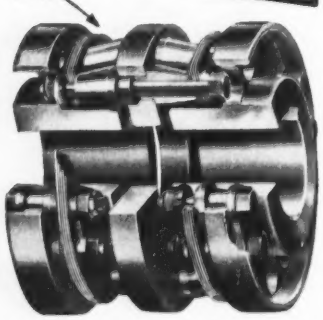

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British Columbia *(Continued)*

and continue exploration work started last year on its Vasseaux Lake property at Okanagan Falls, near Oliver, in addition to investigating the Arrowhead property, a group of eight claims in the Revelstoke area on which it has taken an option. During exploration at the Okanagan property it has been recommended that preliminary milling be undertaken with two sets of screens and fiberizers to yield about 10 tons daily.

★**Canadian Amalgamated Mining and Milling Co. Ltd.** will build a new mill of 85-100 tons daily capacity at Woodbury Creek, near Kaslo. It is expected to be ready by April and will serve small base metal mining operations in the area that have no mill. S. D. Wheeler is mill manager.

MANITOBA

★**Gunnar Gold Mines Ltd.** reports encouragement from the exploration of its property near Euclid Lake, where over 8-million tons of chromite ore is indicated. The process for the successful treatment of lower grade ore has been worked out and finances are expected to be available for the next stage in the project. Gunnar Gold has also completed arrangements to acquire outright ownership of the new uranium property at St. Mary's Channel on the north shore of Lake Athabaska, Sask. As a result of preliminary drilling at this property in December promising uranium values were returned over an area of up to 400 ft. in width and at least 425 ft. long, with the zone still open at both ends.

★**Fairway Flinflon Mines** reports that diamond drilling is scheduled to start on its 8-claim copper prospect at Manistikwan Lake in the Flin Flon area. A survey is also planned for the 59-claim main group on which trenching returned copper values.

★**In the Herb Lake area** there has been a steady increase in the staking of claims since the discovery of uranium in the fall of 1952. Cypress Exploration Corp. Ltd. has optioned approximately 200 claims here and is at present carrying out a sampling program.

NORTHWEST TERRITORIES

★**Consolidated Mining & Smelting Co. of Canada Ltd.** reports extensive test drilling of its lead and zinc deposits in the Pine Pass area on the south shore of Great Slave Lake has given results well up to company expectations. Work started four years ago with a known orebody of 500,000 tons. A surface plant has been built and this year an initial test shaft will

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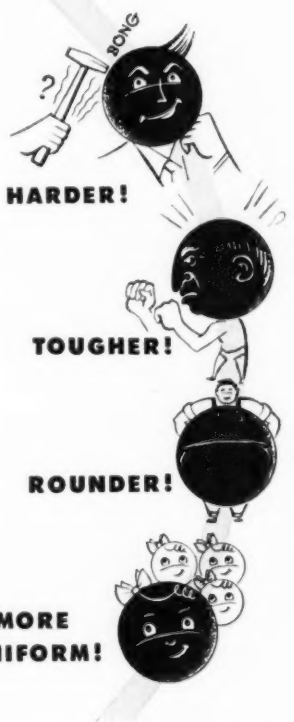

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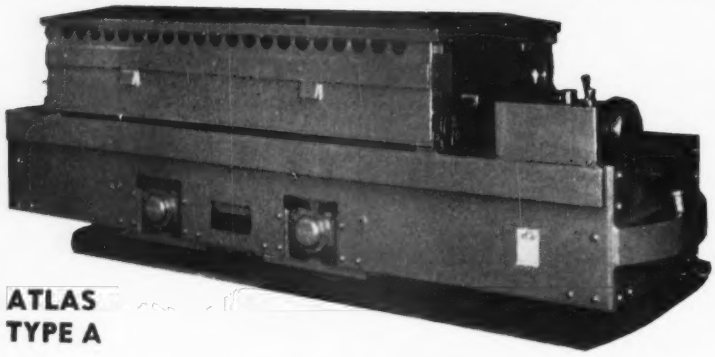

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Northwest Territory (*Continued*)

be sunk. The mineralized belt has been estimated unofficially at an average of two miles wide and 25 miles long. Last year's drilling is reported to have indicated that much of the ore could be mined open pit.

ONTARIO

★Production and profits of **New Dickenson Mines** in the first 11 months of 1952 were greater than those for the full year 1951, giving the company the best year in its history. Bullion sales for the 11 months were $1.4-million, compared with $1.3-million in all of 1951.

★Another gold producer has fallen by the wayside. **Buffalo Ankerite Gold Mines** placed operations on a salvage basis, exploration on the company's Porcupine-area property having failed to disclose the new ore required to keep the mill operating. There is enough known ore left to last only a short time, and efforts are already being made to sell plant and equipment.

★Five companies in the Cobalt area are merging their properties under the name **Cobalt Consolidated Mining Corp.** Four companies, **Gilgreer, Penn-Cobalt, Cobalt Lode,** and **Hellerns Mining & Reduction Co.,** are turning over all their assets. The fifth company, **Silanco Mining & Refining Co.,** retains its Violet and Beaver mines. The new company will have two operating mills, the Cobalt Lode and the Colonial (Silanco) and the partially completed Penn-Cobalt mill.

★Ore reserves at the mine of **East Rim Nickel,** on the east rim of the Sudbury basin, can now be calculated at 1.4-million tons averaging 0.48% copper and 1.37% nickel. Good progress is being made with preparations to install the 500-ton mill that is scheduled to start operating next September. The company is shipping development ore to Falconbridge at a rate of about 3,000 tons monthly.

QUEBEC

★**Ascot Metals Corp., Ltd.,** will embark early in the spring on a program designed to confine mining to its most profitable orebody, the Suffield mine, while low lead and zinc prices continue to inhibit more marginal undertakings. A grade of ore superior to that indicated by diamond-drilling is being stoped out on the Suffield 3rd level and underground drilling from this level at the northern limit of the workings is rapidly enlarging the mine's proven ore. The last hole drilled cut a 29-ft. intersection, apparently highly commercial ore, beyond the most easterly hole previously drilled.

The program was outlined at the company's 3rd annual meeting, held recently in Quebec city. Stockholders ratified sale of the Old Moulton Hill Pyrite property and Albert Metals Corp., Ltd.'s Eustis-Albert group to Sulgas Properties, Ltd.—thus reducing the company's interest in Albert Metals to $50,000, or one-third of the issued stock—and elected Georges Sylvestre, Sherbrooke notary, to fill the vacancy on the board caused by the death of Robert Wadsworth.

Diamond-drilling, the stockholders were told, has turned up a new orebody 3,000 ft. to the south of the Suffield that is comparable in grade and width of intersections to the Suffield.

The company at present is completing exploitation of the most profitable ore remaining in the 9th and 10th levels of the Moulton Hill mine, will shelve plans to extend the shaft another five levels until the price outlook is more favorable.

Ascot's score in 1952 was 207,152 dry tons of ore treated in the Moulton Hill concentrator, 19,042 dry tons of concentrate shipped to smelters, metal content of concentrates having been 13,175,868 lb. of zinc, 3,092,372 lb. of lead, 2,116,461 lb. of copper, 305,773 oz. of silver, 3,565.9 oz. of gold.

President of the company is A. E. Rosen.

★**Barel Duc Mines** has changed its name to **Bar-le-Duc Chibougamau Mines,** following acquisition of a 12-claim copper-gold prospect in Scott twp., Chibougamau area, where a diamond-drilling program will be undertaken.

★**Merrill Island Mining Corp., Ltd.** (507 Place D'Armes, Montreal 1) reports initial results of cross-cutting through its Chibougamau property to the south ore zone give better copper values than were indicated by surface drilling. Average grade now appears to be 4.49% across 20 ft. and 3.69% across 36.5 ft. A combination of drifting and horizontal diamond-drilling on the 150-ft. level of the north ore zone, about 250 ft. east of the shaft, showed copper running 3.44% over a true width of 24.3 ft. An intersection 20 ft. further north showed 5.56% copper over 6.4 ft. true width, and drifting and horizontal drilling 25 ft. to the west of that indicated 3.66% copper over a true width of 28.7 ft. Twenty-five ft. to the south of that intersection was found a parallel structure apparently grading 2.12% copper over 20.5 ft. true width.

SASKATCHEWAN

★**Two more British Columbia companies** and one eastern firm operating in British Columbia are in the Saskatchewan uranium field. Graham Bousquet Gold Mines currently developing a base metal property in the Lynn Creek area of North Vancouver has added to its holdings seven uranium claims in the St. Mary's Channel area of the Beaverlodge camp.

★**Salmo Prince Mines, Ltd.,** originally formed to develop a base metal prospect in the Salmo district, B. C., has acquired an option to purchase the 16-claim WHIZ group at the north end of Black Bay on Athabasca Lake. **Waddington Mining Corp.,** which originally held a 16-claim copper-gold prospect on Jervis Inlet, B. C., acquired 5 claims on option in the extreme northwest corner of Saskatchewan and plans a geological survey of the property. In addition the company is considering another uranium prospect in the Charlebois Lake area.

★**Beaverlodge Uranium Mines Ltd.** reports drifting at a depth of 90 ft. has confirmed persistence to that horizon of the high-grade uranium veins found on the surface of the Beaverlodge Lake property. From an average width of 2.5 ft. uncut face samples indicated a grade of 2.07%.

★**Eldorado Mining & Refining Co. Ltd.'s** 500-ton mill between Beaverlodge and Ace Lakes is expected to be completed by April 30. The company's mine shafts are partially completed. Companies going into production in the area will feed their ore output to the Eldorado mill. Five other firms are underground in the region. They are Nesbitt-Labine, Rix-Athabasca, Pitch-Ore, National Exploration and Beaverlodge Uranium. Nesbitt-Labine has carried out more than 7,000 ft. of underground work.

YUKON

★**Ankeno Mines Ltd.,** which has a 14-claim group in the Keno Hill section of the Mayo silver-lead camp, has awarded a new contract for an additional 1,000 ft. of underground work. This follows completion of a 1,500-ft. contract which resulted in the location of several encouraging breaks which consulting engineer A. W. Johnson has recommended for further exploration.

IN LATIN AMERICA

CHILE

★**The high prices for copper** that prevailed during 1952 in the European markets gave impetus to copper mining here, especially among medium and small producers, who turned out 28,500 metric tons in 1952 against 19,630 in 1951 and 16,600 in 1950.

The price of copper has remained high long enough to tempt gold miners to mine copper instead. This trend is reflected by the fact that gold production and especially gold ores bought by the Mining Bank show a steady

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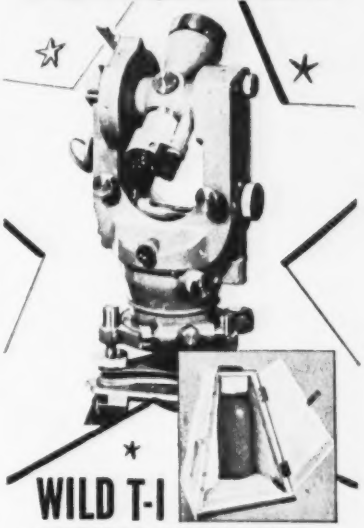

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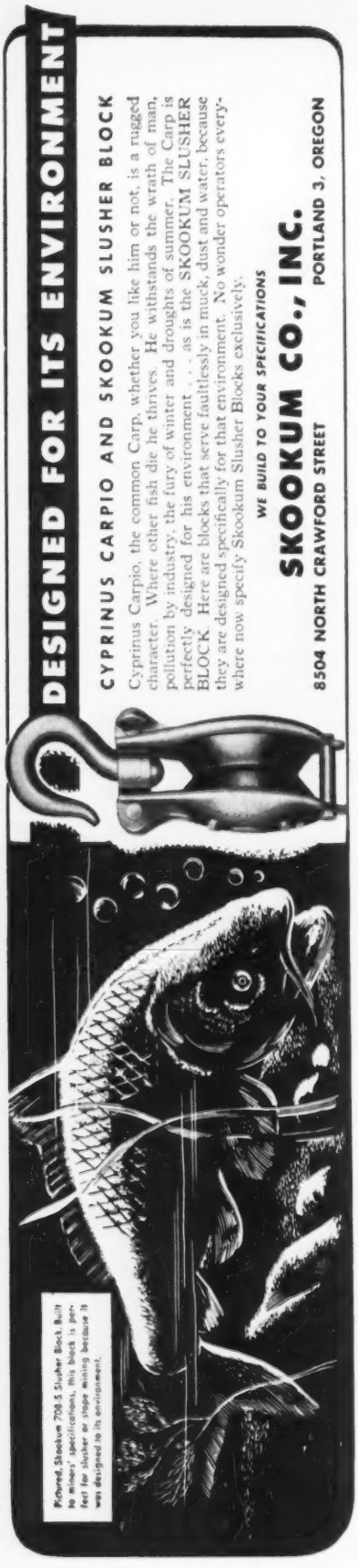
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Chile *(Continued)*

decline, while lately a number of copper flotation mills have been built or started up after long shutdowns, such as Delirio de Punitaqui, at Punitaqui, Ovalle Department, Coquimbo Province (manager, Peña Aguayo); El Morado, Freirina Department, Atacama Province (managers, Callejas Hnos.), and Canto del Cagua, Vallenar Department, Atacama Province (manager, Enrique Hagel).

Cía. Minera Punitaqui, a gold-mining company with a 600-ton-a-day flotation mill at Punitaqui (manager, Ricardo Fritis), has been milling about 300 tons a day of 2% copper ore from dumps of the old mining camp of Tamaya. The ore is trucked 35 mi. to the mill on a contract basis.

Some very small mills are treating dump ore assaying about 2% copper and depend on Chilean mills and flotation equipment built here. Such mills have been constructed at or near old copper mining camps at Andacollo, La Serena, La Higuera, Talcuna, Tamaya, and Combarbalá. These mills handle between 10 and 20 tons of ore per day.

Further north, in the Province of Antofagasta, where the secondary and primary zones are found at considerable depth, copper minerals of ores at dumps and fills are oxidized and cannot be floated. Here the miners have built small leaching plants to treat these ores, using nitre cake that contains about 33% free H_2SO_4 as a leaching agent. Scrap iron is employed as a precipitant. Quantity of nitre cake which can be obtained is limited, but tonnage of low-grade ore at dumps and fillings is appreciable.

The high price of copper has also meant good profits for medium-size companies that are modernizing their milling and mining equipment. Such is the case with Cía. Minera Disputada de Las Condes, Department and Province of Santiago (manager, Arturo Griffin); Cía. Minera de Tocopilla, Tocopilla Department, Antofagasta Province (manager, Rojas); Cía. Miniere du M'Zaita, Quillota Department, Santiago Province (manager, Roberto Bourdel), and Cía. Minera Merceditas, Santiago Province (manager, Jaime Irarrázaval).

★Production from the **three American-owned copper porphyries** has been adversely affected during the last few years by strikes, of which there have been a great many. The starting up of the new sulphide plant at Chuquicamata in the middle of November last was not felt on statistics until this year.

★The Chilean Central Bank (equivalent to the U. S. Federal Reserve Bank) reported that until January 22 it had sold **270,000 metric tons of copper at 35.5¢ per lb.** fob Chilean ports for a profit of $68.31-million.

★Mine, mill, power plants, and aerial ropeways of **Cía. Minera Disputada de Las Condes**, 40 mi. out of Santiago, have been down on account of a strike growing out of a disagreement on wages. Because inflation is rising steadily in Chile, labor unions will not ordinarily sign agreements for more than a year and, when bargaining, demand a higher percentage increase in wages than corresponds to the rise in the cost of living, so as to compensate for the previous year's lag. Hence, strikes have been very frequent in all industries in Chile in the last few years and will continue to be so unless the inflationary spiral is arrested.

★**Cía. Minera Aysen**, Chile Chico, Province of Aysen (Ricardo Fritis, manager), with the only mill concentrating lead and zinc ores in Chile, exports lead concentrates via Argentina, there being no roads to the sea on the Pacific side. Zinc concentrates are stored for some future time when a rise in the price of the metal will make shipping profitable. Roads in Aysen are few and poor.

★Officials and a mining engineer from the French company that owns the Manto Verde copper deposit, 12 mi. from the railroad station of El Salado and 22 mi. from the port of Chañaral in Atacama Province, recently inspected the property. This orebody has several-million tons of **low-grade oxidized copper ore** in a gangue, which is mostly hematite. The owners propose to beneficiate the ore by leaching it with a brine solution containing SO_2 gas. Concentrated brine can be obtained in large quantities from natural springs in El Salado River (hence its name) which carry 140 grams of NaCl per liter, while sponge iron for precipitation can be obtained from the hematite gangue in the ore, which is plentiful. It has been proposed that pilot plant tests be carried out in the El Salado flotation mill, belonging to the Mining Bank. Agents for this company in Chile are Fontaine & Salvo, of Santiago.

★**Kennecott Copper Corp.'s** Braden Copper Co. lost production of 9,000 short tons of fire-refined copper, and the government lost an estimated $5.5-million as a result of the recent strike. The men will receive a general pay increase of 25%, 30% for skilled workers. There will also be paid a subsidy of 300 pesos per worker per month for housing.

MEXICO

★Salvador Ugarte, president of Banco le Comercio, predicted the **higher price of silver would boost 1953 output** to more than 49-million oz. produced in 1950. Bankers here were counting on the price to go to 90¢, saying the Bank of Mexico would not resume sales on the world market until that price should be reached. Output last year was conservatively estimated at 45-million oz.

★The Mining Chamber reported **cheap**

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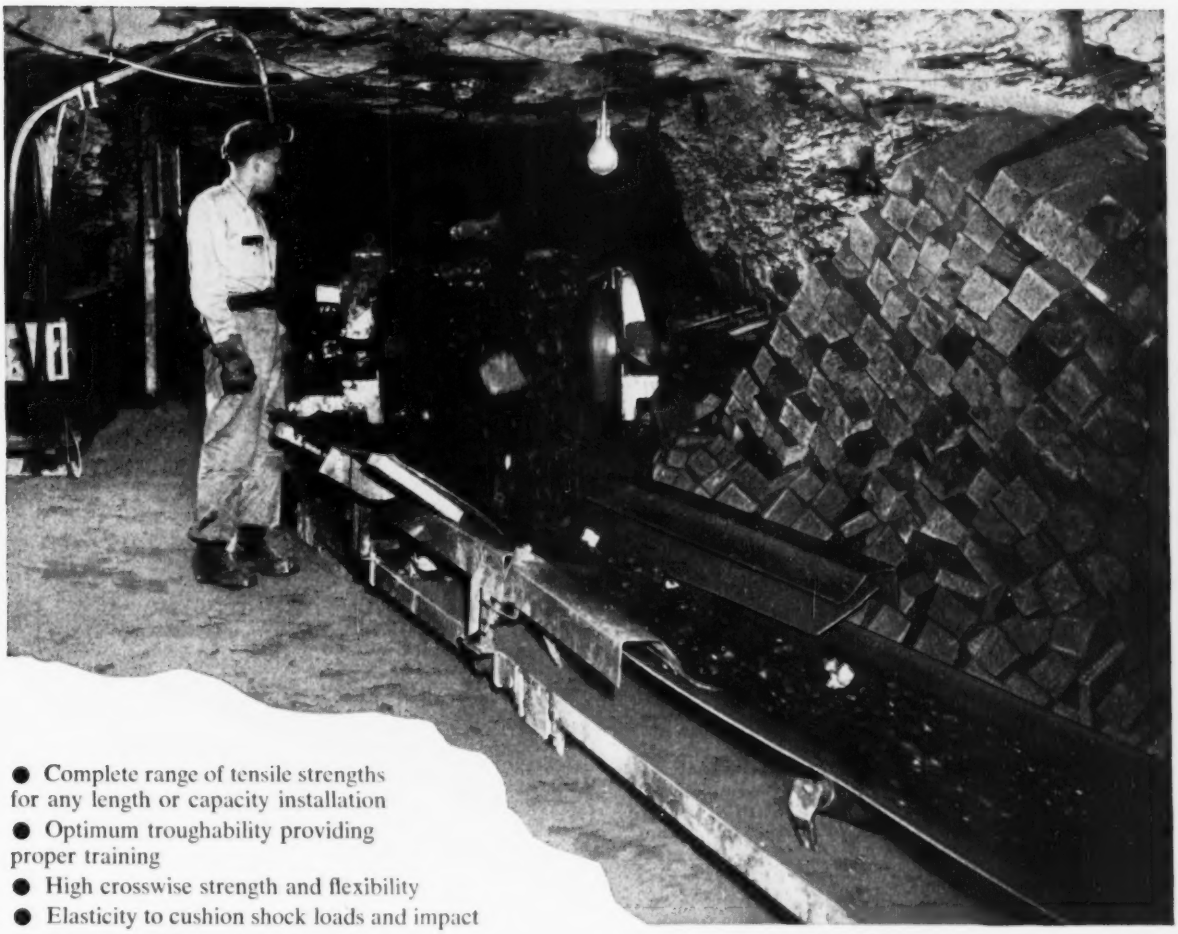

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Mexico *(Continued)*

lead was hitting the smaller producers hard, especially in Zacatecas, where it was reported many mines were being worked on reduced shifts and some had closed down.

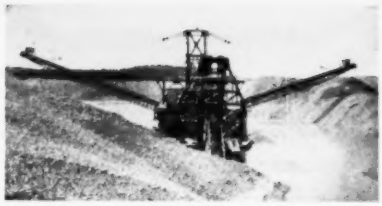
★Union labor launched its spring campaign at **Fresnillo Co.,** in Zacatecas, **Piedras Negras,** Coahuila, and two iron-steel firms, **Altos Hornos de Mexico,** of Monclova, Coahuila, and **La Consolidada,** in Mexico City, with demands for pay increases of as much as 60%, but union officials indicated they were hoping for settlement of an average 20% increase. Secretary General Luis Quiros Islas said the union would try to get a $12.36-million (107-million-peso) hike for 85,000 members, based on increased living costs.

★Federico Deschamps Fernandez settled wage debts the Federal Board of Conciliation and Arbitration said he owed his long-striking workers by **turning over to them his La Azul lead-silver-gold mine** at Acamixtla, in Guerrero's Taxco district. The Federal Board ordered Fernandez to pay $36,-900 (317,879.19 pesos) to bring his workers on the job. They, in turn, agreed to amortize, settling for $29,-000 (254,789.30 pesos) and possession.

VENEZUELA

★A sulphur refinery with an annual capacity of 250,000 tons will be constructed at this eastern port city (state of Sucre) by a combine incorporated as the "Venezuelan Sulphur Corporation, C. A.," headed by Benjamin S. Dowd. The plant will be completed within 14 months and cost an estimated Bs. 15,000,000 ($4,545,-454). Dowd identified his partners in Venezuelan Sulphur as John M. MacDonald, president of Loftus Engineering Corp. of Pittsburgh, Pa.; Dante Brogi, president of Neptune Meter Corp. of New York and Dr. Octavio Calcño Vethancourt, Venezuelan lawyer.

He said studies were in the final stage regarding the content of sulphur in the ore of the "Costa Mora" mines of "El Pilar" (Benítez district) of Sucre which will supply the refinery. The quality of the mineral has been tested in laboratories in the U. S. and Europe and, now, a technician, W. H. Marquett, is on the site to confirm the findings, which were not made public. Dowd said drilling equipment was being used for exploratory work in the mines. He added that the ore would be transferred from the mouth of the mine to the refinery by means of an aerial cable, covering a distance of 18 kilometers (12.6 miles). Initial work will require 300 workers, he said. The Venezuelan sulphur demand will be satisfied first, Dowd assured, noting that the product was basic for industries such as tires, textiles, paper, soap, etc.



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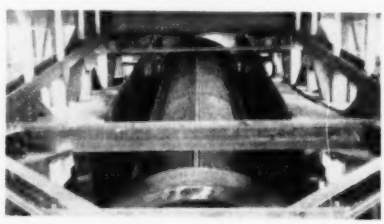

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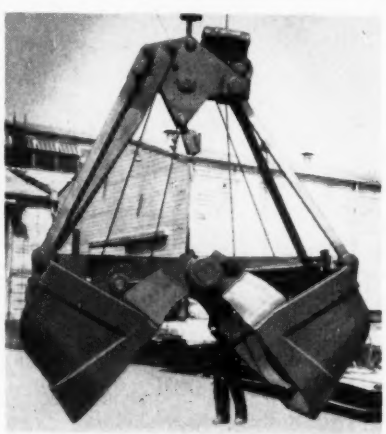

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IN AFRICA

★What looked like a unique feat of engineering became a washout when a second inrush of water at the 5,350-ft. level inundated Free State **Geduld's** No. 2 shaft. Soon after Free State had installed pumping facilities to carry off the normal 43,000-gpm. seepage into the shaft, first encountered last fall, water burst through from an adjacent fissure, instantly raising the intake to 95,000 gpm. Having used balers to retard the rising surface only long enough for salvaging of equipment deep in the shaft, the miners then reversed tactics, pumping additional water into the shaft to speed the day when the flow of water should be reversed—out of (rather than into) the shaft. When the surface was 52 ft. short of the shaft collar, an outward flow of about 50,000 gpm. was observed. The breaches in the shaft wall were then sealed by cementation through cement rangers (pipes that conduct cement from the surface, more than a mile away) an accomplishment many competent engineers considered impossible. That the seals were holding was attested by a steady decline in the rate water was flowing out of the shaft. When 12,000 pockets of cement had been deposited, the operators were confident the job was done and dewatered the shaft to resume normal operations. Only after this was done and the work had been inspected from the shaft bottom did the company announce its (then apparent) success. Observers say that the company's decision to seal the break this time by installing a cement plug indicated that the second break is not as serious as the first, that a cement plug would be quite inadequate if it were.

★**Another Free State gold mine,** Harmony G.M., has been added to the list of uranium producers bringing the total to 15. The plant is expected to be in production by the latter half of 1954.

★**West Driefontein mine,** which started production in the middle of 1952 seems well on its way to the position of the richest gold mine in the world. During the first six months of operation, 150,915 oz. of gold were extracted from 276,000 tons of rock, yielding a profit of approximately $2,750,000. During January 34,000 tons milled yielded 23,803 oz. Milling capacity is being built up to 125,000 tons per month.

★**The first profits** from the extraction of uranium from gold-bearing ores at West Rand Consolidated Mines have been announced. Since the plant first started in September until Dec. 31, 1952, profit amounted to more than $350,000 compared with a net profit of $1,130,000 from gold mining for three months. The uranium was derived from ore drawn from the Bird Reef series, on which 10,629 ft. of development was completed.

★**A strong attack** on the South African Government's taxation of uranium production has been delivered by the president of the Chamber of Commerce, C. S. McLean. He said that the fact that uranium production would begin in the Free State before gold mines reached full production showed how inequitable the method of taxing new uranium production is. The State has decided that it will be taxed on the same scale as gold mining.

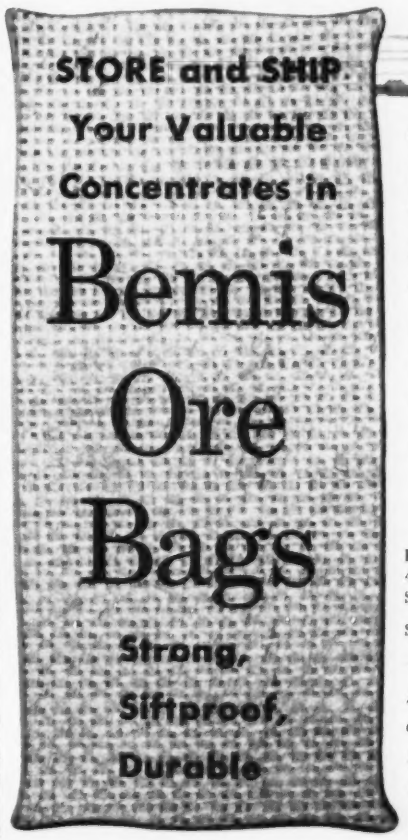
★**A serious decline** in the supply of African workers to the gold mining industry is indicated in the latest official figures. In December the African labor force fell to less than 270,000 for the first time since January 1949. This is 12,600 less than a year ago.

★Mining companies are investigating **possible large copper deposits** in five different areas in Southern Rhodesia. Total ground held covers 279 square miles. Rhodesia Copper Ventures has registered three prospecting areas in Sinoia district. The Wedzwa Syndicate has registered ground near Bulawayo. Messina (Transvaal) Development, which operates the Messina mine in Northern Transvaal, has registered prospecting rights over 100 square miles of the lower Sabi Valley.

★Further details of the technique **to recover uranium from gold residues** have now been released. The filter cake discharge from the gold plants is repulped and agitated in dilute sulphuric acid in conical-bottom tanks similar to Brown tanks. The pulp is then filtered in two stages on drum filters and the solid residue discharged to slimes dams. Manganese dioxide is used as an oxidising agent in leaching the uranium solution, and goes into solution as manganese sulphate. The barren solution from the uranium purification system contains this manganese. Iron, alumina and silica in this solution are precipitated and filtered. The manganese is then precipitated as the hydroxide, oxidised to the dioxide and returned to the uranium recovery section.

The usual canvas filter cloths have a very short life under acid conditions and many substitutes have been tried. It is considered that cotton will be replaced with a synthetic fiber.

Another major problem is that as the filter cake from the gold plant is repulped with acid it becomes at least twice as difficult to filter and at one stage it was thought that the number of filters would have to be doubled, which would have been a serious matter in view of the high cost of an acid-proof filter and all its auxiliary equipment. It has been discovered, however, that the addition of a small quantity of animal glue to the acid pulp speeds up the filter rate. The mechanics are not yet fully understood and no substitute has been found.



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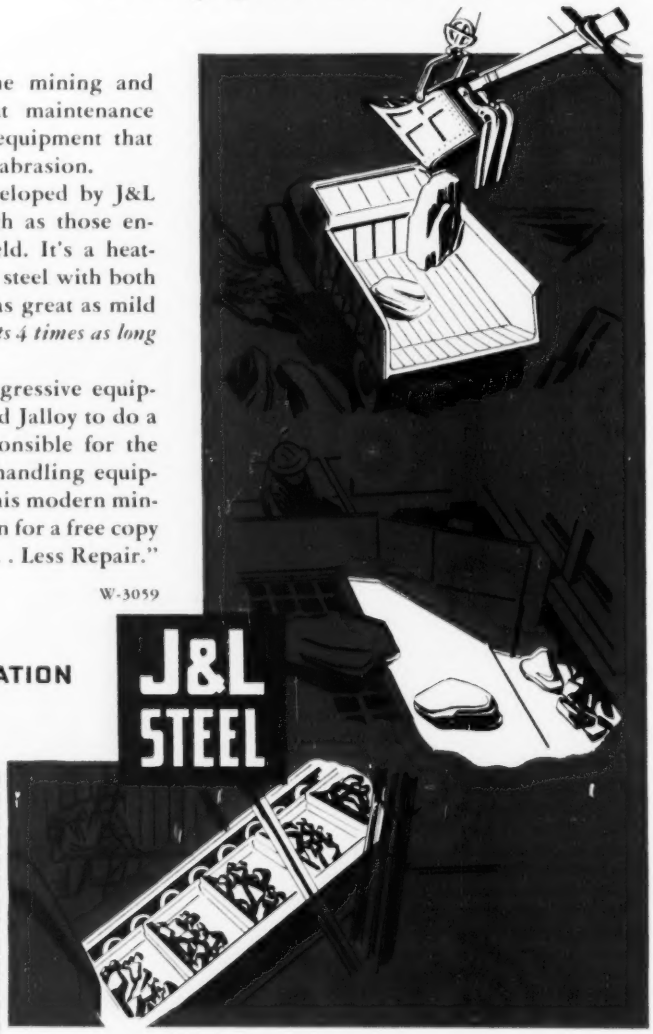

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IN AUSTRALIA

★The present rate of extraction of **manganese ore at Peak Hill,** Western Australia, is about 1,200 tons per year. Technical improvements and better transportation are expected to permit an output of 25,000 to 33,000 tons a year. Most of this would go to the U. S. Ore reserves at Peak Hill are estimated to be 500,000 tons of 44 to 48% manganese.

★Considerable disappointment has been voiced by tungsten producers in Northern Territory because of the drop in wolfram prices. Many operators are considering resumption of gold mining and copper prospecting.

★Production of lead concentrates by **New Broken Hill Consolidated, Ltd.** for the year ended Dec. 31 totaled 25,284 as compared with 22,833 for the previous year. Zinc concentrate production in the same period rose from 46,232 tons to 51,839 tons. During 1952 this company treated 235,478 tons of ore assaying 8.6% lead, 1.9 oz. silver, and 12.4% zinc.

★**Zinc Corporation, Ltd.** produced 87,353 tons of zinc concentrates in 1952 as compared with 88,872 tons in 1951. Lead concentrates produced in 1952 totaled 77,214 as compared with 80,789 for 1951. The company treated 449,282 tons of ore assaying 13.5% lead, 3.1 oz. silver, and 11.2% zinc.

★Work has begun on a new tungsten and bismuth project in Tasmania. This follows expansion of the former Moina Syndicate of a new company which will be known as Moina Tungsten Tin Mining Co., N.L.

★Preliminary sampling of two small mineralized areas near Katherine indicated the possibility Australia **may become independent of tin imports.** It's been suggested that application of modern mining methods might bring in a deposit of tin ore at Maranboy as a field. A company is now working this deposit. Further exploration is under way 20 mi. from Maranboy, at Yeuralba, where surface indications gave promise of large, low-grade orebodies of tin and wolfram.

IN EUROPE

AUSTRIA

★Aluminum production, estimated at between 36,000 and 37,000 tons in 1952, was up 10,000 or 11,000 tons above 1951 output and headed for another substantial increase this year. **Ranshofen Vereinigte Aluminiumwerke,** which turned out 31,000 tons last year, has capacity for 50,000 tons a year and was expected to produce 40,000 tons in the current year if the supply of electric current is adequate. Ranshofen has been operating 240 electrolysis units this winter, compared to 80 last winter and a peak 720 last summer. It's estimated that **Salzburger Aluminiumwerke,** with 7,000 tons capacity, produced 6,000 tons in 1952.

★National production in 1952 included 2.6-million tons of iron ore and about 1.17-million tons of pig iron. The figures represent increases over the previous year's output of 10 and 11%, respectively.

FRANCE

★The Saar Valley's iron and steel industry is recording 1952 as a banner year. Output climbed to 2.5-million tons of pig iron, compared to 2.369-million in the previous year, and 2.8-million tons of steel, compared to 2.58-million.

GERMANY

★Hampered by a paucity of electric power and the fact that Canadian output can be marketed at 20% less than its price, West Germany **jumped aluminum output** from 7,000 tons in 1951 to 100,000 in 1952. Nearly all native output plus substantial imports from Canada are absorbed by German consumers who re-export it as fabricated products. Outlook was for increased imports of both bauxite, which comes chiefly from Greece, Yugoslavia, and France, and aluminum, from Canada. Greece, bolstered by MSA financial and technical aid, has agreed to ship 600,000 tons of bauxite to West Germany over a four-year period.

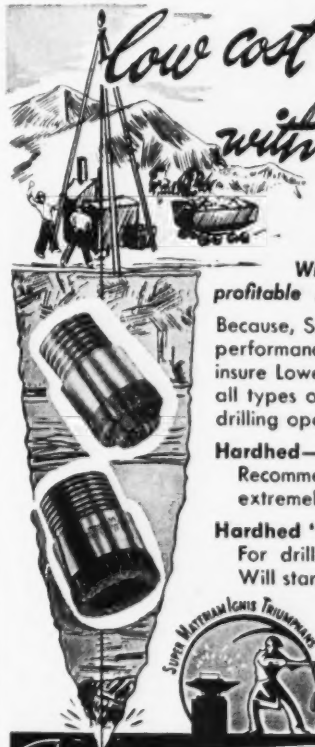
★Iron ore output of West Germany in 1952 is put at 15.4-million tons, compared to 12.9-million in 1951. Domestic production satisfied about 60% of the ore requirement of domestic smelters during both years.

GREAT BRITAIN

★Producers of refined iron, anxious to keep Continental and other customers on their books, are hopeful that they can induce the government to permit them to export on the order of 1,000 tons per quarter all told.

NORWAY

★This country, which in 1952 produced 51,700 tons of aluminum, is expected to account for about one-third of the 150,000-ton-a-year increase projected for Europe on the basis of expansion plans announced in the past two years. Bulk of the Norwegian increment is expected to come from the 40,000-tons-a-year reduction plant



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Norway *(Continued)*

going up at Sundalsora, in the western part of the country, scheduled for completion in 1954 or 1955.

YUGOSLAVIA

★The aluminum electrolysis plant and rolling mill at **Razina, Croatia,** and the alumina and aluminum plant at **Strnisce, Slovenia**—both scheduled for completion next year—will absorb 9,277-million dinars for construction in the currnet year. When the new plants are in operation, Yugoslavia expects to be turning out 22,500 tons of aluminum ingots and 23,000 tons of rolled aluminum products a year, compared to 2,049 tons of ingots and 1,500 tons of rolled products in the first 10 months of 1952.

Production of bauxite, alumina, and aluminum have increased steadily for several years, but so have the country's imports of aluminum. Bauxite production in the first 10 months of last year amounted to 500,880 metric tons, compared to 453,357 in the entire year 1951 and 200,892 in 1950. Aluminum ingot production was apparently off slightly last year, 2,050 metric tons in the first 10 months, compared to 2,828 in all of 1951; but the decline compensates little for the increases through the years, up from 567 tons in 1946 and 1,931 in 1950. At the same time, however, aluminum imports had risen to 1,550 metric tons in 1951, compared to an annual average of 865 tons in the immediately preceding five-year period.

Yugopress, the Yugoslav news agency, put the country's bauxite reserve at 100-million tons.

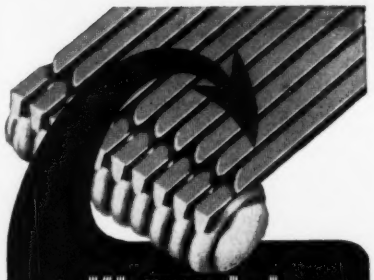
★Yugopress reported copper production last year bettered that of 1951 in all departments—blister up from 32,011 to 33,000 tons, electrolytic up from 14,004 to 19,000, ore up from 1,173,199 to 1.3-million. As the Bor reserve nears depletion, producers have been developing plans to exploit deposits in the Majdanpek district in eastern Serbia.

IN THE PACIFIC

FIJI ISLANDS

★**The search for gold** has been markedly intensified, especially in the Vatukoula field, in response to tax relief measures and royalties recently put into effect by the Fijian Government. Modern equipment is being brought in, and producers are taking interest in a greater proportion of marginal ores.

Loloma and Emperor, the two chief gold producers in the Islands, ended the fiscal year as follows: Loloma's



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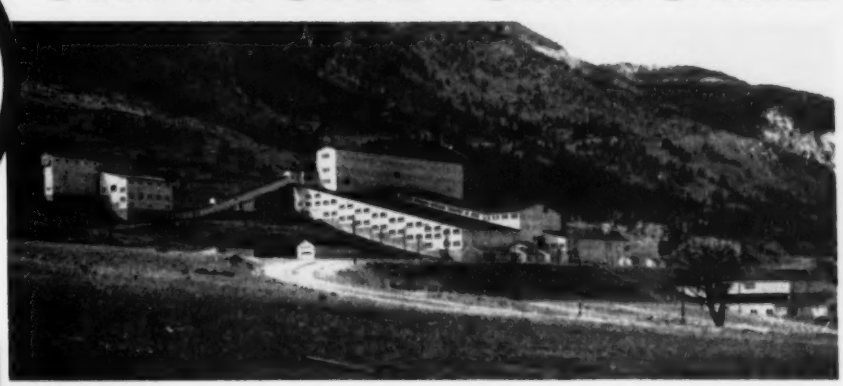

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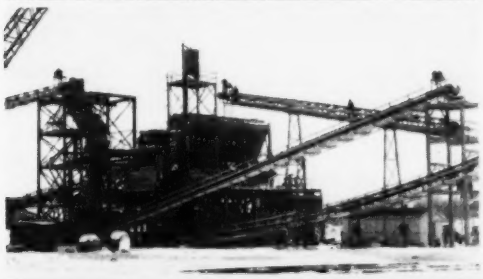

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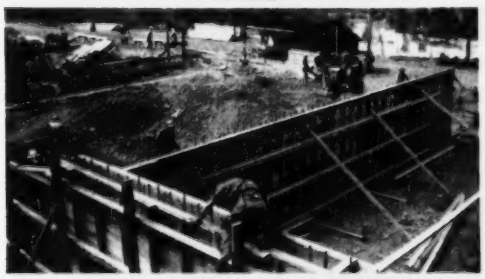

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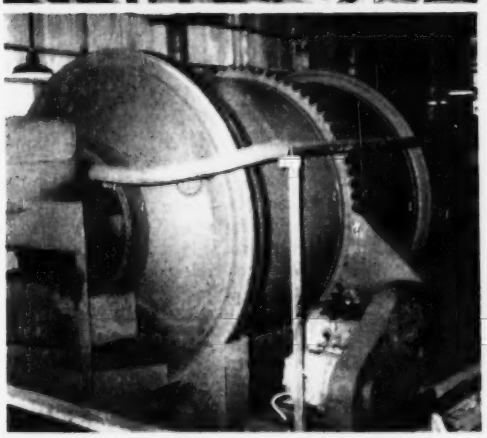

4

Now nearing completion by Western Knapp Engineering Company is this chrome concentrator being restored for the American Chrome Company. Located near Columbus, Montana, this plant will have a capacity of 1,000 TPD employing gravity concentration for treatment of ore. When the decision was made to reactivate this plant WKE was assigned responsibility for the detailing, construction and equipping of this vital addition to America's industrial strength.

The specialized skills and practical know-how required by this project illustrate again the ability and experience offered by WKE to clients in the mineral dressing field, both metallic and non-metallic.

If you are contemplating plant design and construction, or expansion of present facilities, write for full information about WKE services.

● *Among other current WKE projects:*

FLUORSPAR **1** **KAISER ALUMINUM & CHEMICAL CORP.**, Fallon, Nevada. Engineering and equipment procurement service was furnished by WKE for this 100 TPD fluorspar flotation plant recently placed in operation.

IRON **2** **COONS-PACIFIC CO.**, Eveleth, Minnesota. 300 TPH iron washing plant recently completed with participation by WKE in design and construction. Equipment includes Heavy Media Wemco Mobil-Mill, other gravity concentration units and auxiliary washing equipment.

LEAD-ZINC SULPHIDE **3** **CANADIAN EXPLORATION, LTD.**, Salmo, British Columbia. Now in progress, project calls for expanding capacity from 850 to 2,000 TPD in a lead-zinc sulphide selective flotation plant. Design, construction and material procurement by WKE.

COAL **4** **WISE COAL & COKE CO.**, Dorchester, Virginia. A 160 TPH Heavy Media Separation plant for coal washing. Design and construction by WKE. Plant includes Wemco Mobil-Mill with Two-Compartment Drum Separator (see photo).

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Masks packed individually. Refills packed 25 to envelope. No. 2 (heavyweight) Refills contain twice as much filtering cotton as No. 1.

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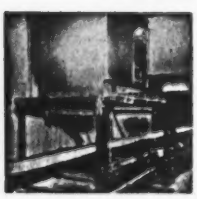

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Applicable to any size belt conveyor, horizontal or inclined. An accurate and dependable means of keeping constant check on production.

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TREE TRUNKS protectively embrace buildings in the pit of Sweden's Kiruna iron mine, where 25-ton dynamite explosions occur. Underground mining goes on here simultaneously.

Fiji Islands *(Continued)*

profit rose to £189,092, and its reserve was 40,000 tons proved, averaging 19 dwt., and 18,000 tons probable, averaging 10 dwt. **Emperor,** with profits down to £89,820, reported reserves of 890,000 tons proved, averaging 7.9 dwt., and 150,000 tons probable, averaging 7.2 dwt.

PHILIPPINES

★**Japan is prepared** to send a technical mission of 139 specialists to the Philippines, according to reports, to assist in development of manganese, iron, chrome, copper, coal, gold and asphalt. As a sort of guarantee that Japan was not attempting to assume technical domination of the Philippine mining industry, a Japanese technical school would be set up where Filipinos would be trained by the Japanese to carry on their own development of mineral resources.

★**The gold mining industry** is hopeful that relief will be speedily forthcoming from the 17% exchange tax on dividends earned by foreign investors and on repatriation of capital investments, as well as reduction of corporation tax and the ad valorem tax on production. Measures in support have been prepared by the Philippine House Ways and Means Committee following conferences with Manila Stock Exchange representatives and the Philippine Chamber of Mines. In any event, the 17% excise tax is due to be reduced to 12½% on July 1, 1953.

★Development on the lower levels of **Mindanao Mother Lode** has failed thus far to improve the ore reserve position but company men think that present rate of production of about 11,700 tons per month of $11.50-per-ton ore can be maintained for some time ahead.

★**Production at the Itogon mine** in the Baguio area in Mountain Province continues satisfactory. Several high grade veins have been opened up including the Itoe. Under the amended provisions of the minimum wage law the company is permitted to deduct 1 peso per shift as a charge for housing, water, and light, so that the production cost remains the same as before the law went into force.

★In the Marsman-operated **San Mauricio mine** in the Paracale district a new vein has been found that runs better than $50 per ton with a width of 5 ft.

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THE M.S.A. MINEPHONE COMMUNICATION SYSTEM . . . answers mechanization's call for faster, safer HAULAGE OPERATIONS

Sending dispatcher's orders instantly and simultaneously to all motormen, who can reply or communicate with each other *while trips are in motion,* this modern underground communication system coordinates haulage movements with production demands . . . maintains smooth, continuous trip movements throughout the mine.

Messages, transmitted on an "open line" hook-up, keep the track clear for outgoing loaded trips and incoming empties. Keeping every trip on the move means less wear and tear on equipment; time is saved; injury is avoided.

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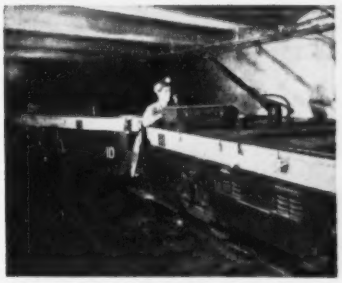
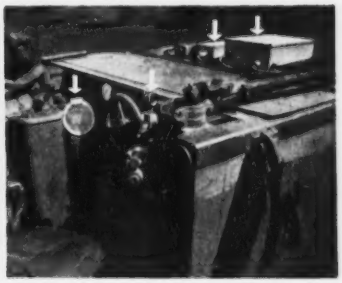


Motorman reports his position at cross-over.

Motorman, ready to go into mine, asks for right of way.

Trip unloader advises conditions at his station.

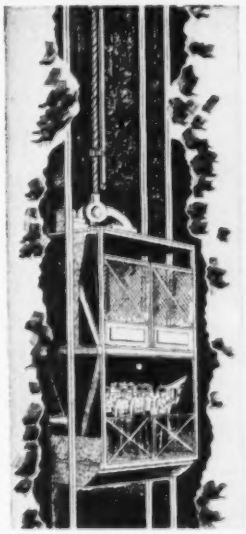


Typical compact MinePhone installation on top of locomotive.

THE M.S.A. HOISTPHONE COMMUNICATION SYSTEM . . . gives hoisting operations a lift . . . for greater production — safety

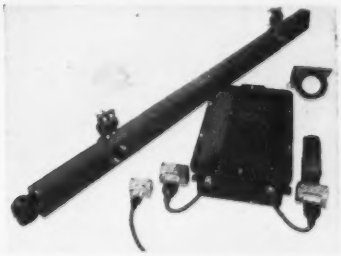
Here's the voice communication system that assures accurate, instant response between the hoisting engineer and cage. Whatever the job—load leveling—shaft repairs—shaft inspection trips—passenger transportation—the M.S.A. HoistPhone provides dependable, continuous voice communication at any level, and when cage is in motion.

The HoistPhone can be heard above noises of running equipment—is free of transmission noise and outside interference. Existing wiring, hoist cable and shaft frame can be utilized to carry the signal. It is simple to use—dependable in operation. Write for details on construction, flexibility, and design details.



HoistPhone permits positive control of the cage at any point in the shaft whether engaged in handling personnel, materials, repair or maintenance crews.

Hoist deck showing level indicator and M.S.A. HoistPhone. Voice control eliminates misunderstandings often caused by bell or horn signals.



Complete cage assembly showing transmitting and sending loop, transmitter-receiver, power supply box, microphone with control switch and speaker.

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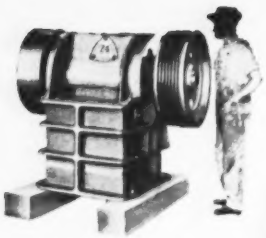
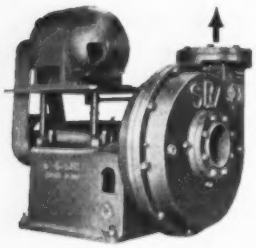
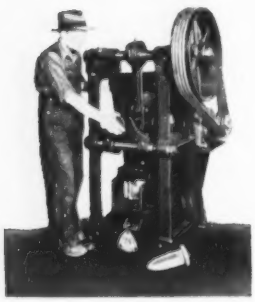


Denver Forced Feed Jaw Crusher

Denver Vertical Sand Pump



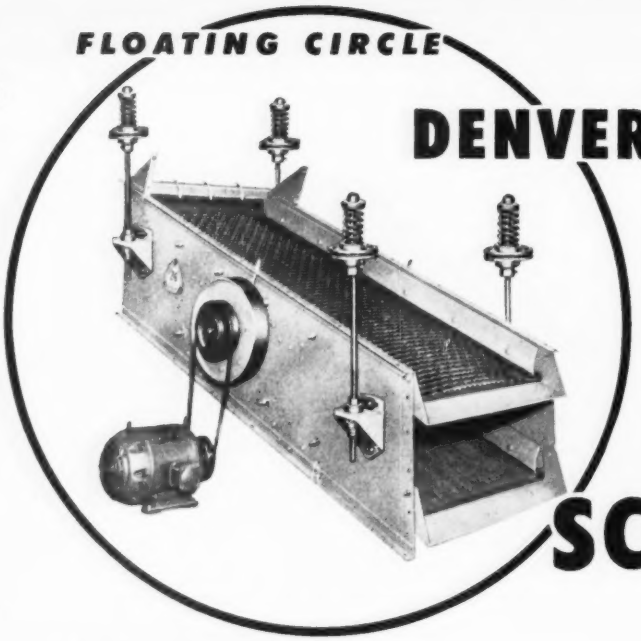
Denver SRL "Rubber Lined" Sand Pump



Denver Adjustable Stroke Diaphragm Pump

FLOATING CIRCLE

DENVER-DILLON VIBRATING SCREENS



OPERATING DATA

Horsepower — 3 H.P. (for 4′ x 8′ Single Deck)

Shipping Weight — 1490 lbs. (4′ x 8′ single deck bare screen for domestic shipment).

Low Power Cost — Floating circle, 2-bearing action causes rapid screening; oversize actually floats over screen; power cost is reduced as much as 50%.

High Capacity — This screening action (1) gives more accurate sizing (2) eliminates dead weight; permits less bulk in screen frame (3) gives full screen area capacity.

Low Operating Cost — Rugged, simple construction results in minimum repairs and down time. Shaft and bearings support no other load. Pressure lubrication prevents entry of dirt or moisture. Tension on screen cloth is easily maintained. Rubber cushioned camber bars arch screen section; prevent whipping and lengthen life of screen cloth.

ALL SIZES

Pilot plant and mill sizes available from 1′ x 3′ to 5′ x 10′.

Let us quote you prices on these excellent screens. Standardization and quantity production mean low costs, good deliveries.

Complete ore dressing equipment from...testing...to feeder ...to dryer.

DIMENSIONS

Screen Size			*Dimensions			*Approximate Shipping Weight, Lbs.	
W	L	H.P.†	L	W	H	Domestic	Crated for Export
1′	3′	⅓	3′-2″	2′-0″	2′-4″	240	290
1′	4′	½	4′-1″	2′-0″	2′-9″	280	335
1½′	3′	½	3′-2″	2′-6″	2′-4″	275	330
1½′	4′	½	4′-1″	2′-6″	2′-9″	320	385
1½′	6′	¾	5′-11″	2′-6″	3′-6″	400	480
2′	4′	¾	4′-1″	3′-0″	2′-9″	380	455
2′	6′	1½	5′-11″	3′-0″	3′-6″	980	1175
3′	6′	2	6′-1″	4′-3″	3′-9″	1075	1290
3′	8′	2	7′-11″	4′-3″	4′-7″	1310	1570
3′	10′	2	9′-9″	4′-3″	5′-4″	1600	1920
4′	8′	3	8′-1″	5′-5″	5′-0″	1490	1790
4′	10′	3	9′-11″	5′-5″	5′-9″	1760	2110
4′	12′	3	11′-9″	5′-5″	6′-6″	2640	3170
5′	10′	5	9′-11″	6′-9″	5′-11″	2740	3290
5′	12′	5	11′9″	6′-9″	6′-9″	3015	3620

*Applies to Single Deck Screen, less drive, mounted at 22½° slope.
†Applies to Single Deck Screen.

DECO FLOTATION ENGINEERS — DENVER EQUIPMENT COMPANY 24 HOUR SERVICE

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1400 SEVENTEENTH STREET · DENVER 17, COLORADO

Specification Bulletin Sent On Request

SCREENS IN STOCK

Limited number of 4′ x 8′ and 3′ x 6′ single deck Denver-Dillon Vibrating Screens (bare screens) are in stock now, assembled, ready to ship. Additional deck can be added to make 2-deck screen. These screens are subject to prior sale. Phone or wire your order today.

S-5112

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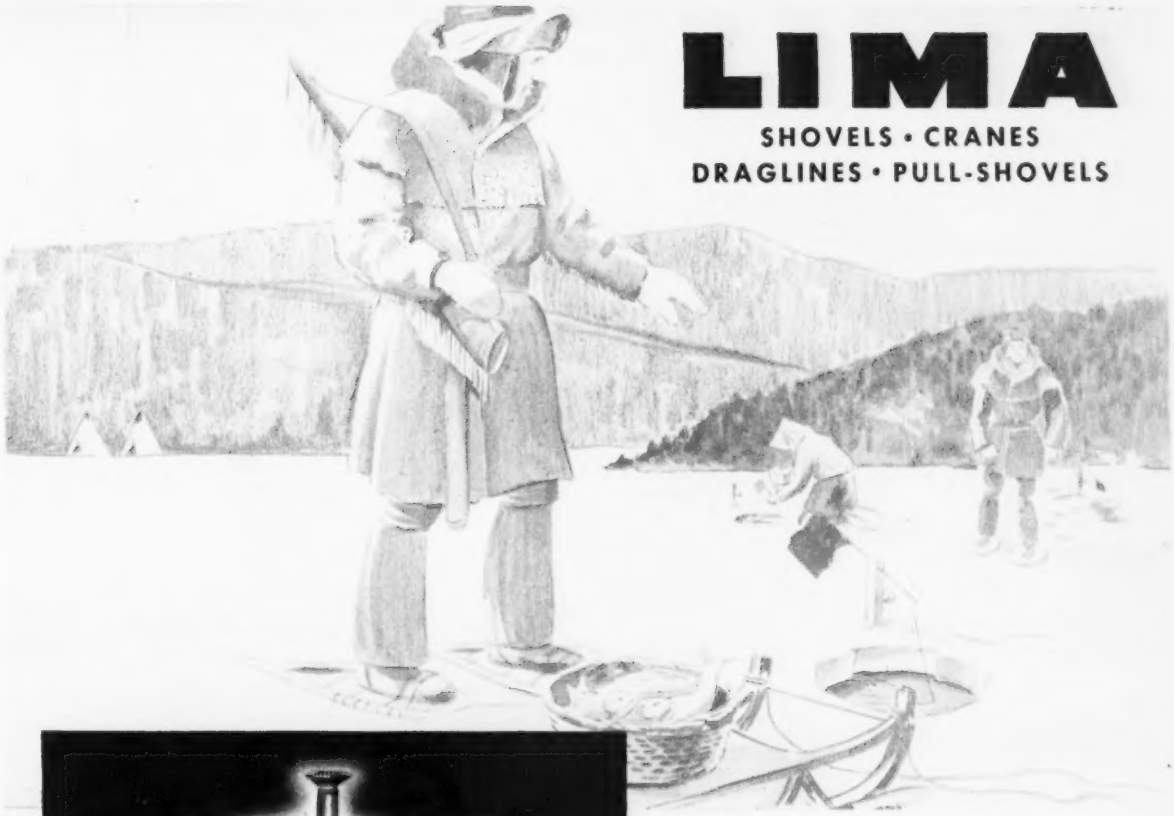
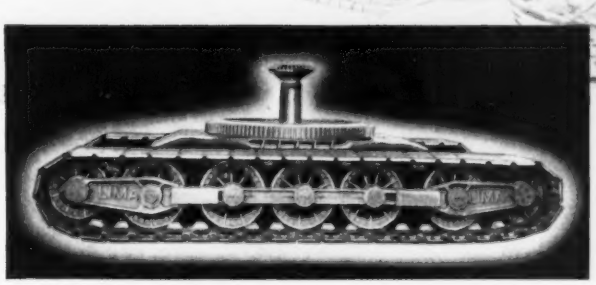
SHOVELS • CRANES
DRAGLINES • PULL-SHOVELS





The Right Footing to Get There when the Going's Tough

When the snow is soft and deep, the smart sportsman doesn't bog down trying to buck it. He straps on his snow shoes—and the increased bearing area lets him go up and over the drifts.

It makes equally good sense to buy a shovel, crane or dragline that's built to ride over *not through* the soft spots—a LIMA, of course.

The crawlers on a LIMA are long and wide to give ample stability. Slightly elevated at the front to give a sled runner effect—self-cleaning—the LIMA crawler takes the tough spots right in stride.

So, when you're looking for equipment with greater working range—that will operate in the bad spots as well as the good ones—call your nearest LIMA Sales Office or Distributor. You'll find there are many other features—air actuated clutches, wide drums, anti-friction bearings throughout, etc.—that will help you set new performance records.

LIMA SHOVELS are available in capacities from ¾ to 6 yards.

LIMA CRANES are available in sizes to 110 tons capacity.

LIMA DRAGLINES are available in variable capacities to suit specific needs.

Wheel or truck mounting is available on machines of ¾ and 1½ yards capacity.

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SHOVELS • CRANES
DRAGLINES • PULLSHOVELS

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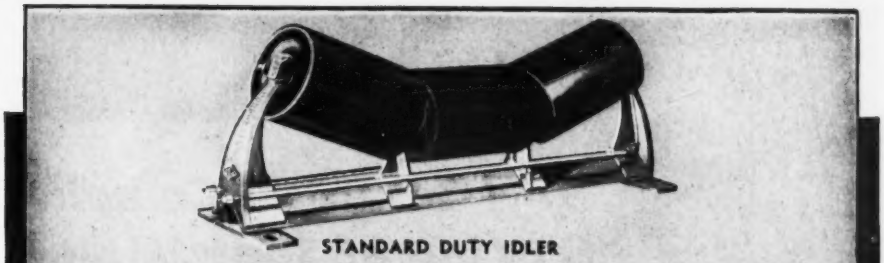
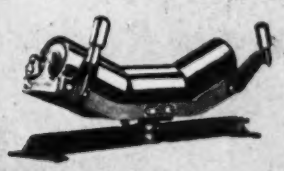
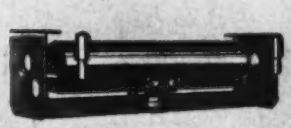


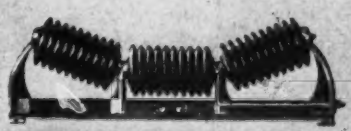
STANDARD DUTY IDLER



SELF-ALIGNING TROUGHING IDLER



SELF-ALIGNING RETURN IDLER



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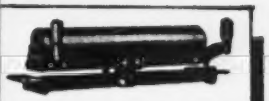
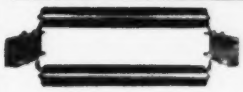


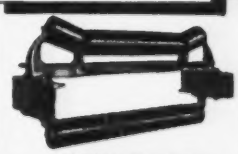
SELF-ALIGNING FLAT BELT IDLER



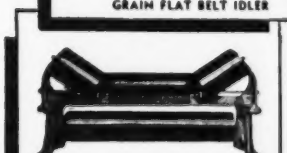
FLAT BELT IDLER

HEAVY DUTY IDLER

GRAIN FLAT BELT IDLER



PICKING TABLE IDLER



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Belt conveyors are used for handling many types of material. For this reason, Continental manufactures a variety of Idlers each designed to best take care of a particular application.

When ordering your next Belt Conveyor specify Continental Idlers and take advantage of our complete line.

Most standard size Idlers can be shipped FROM STOCK. Other sizes can be shipped promptly.

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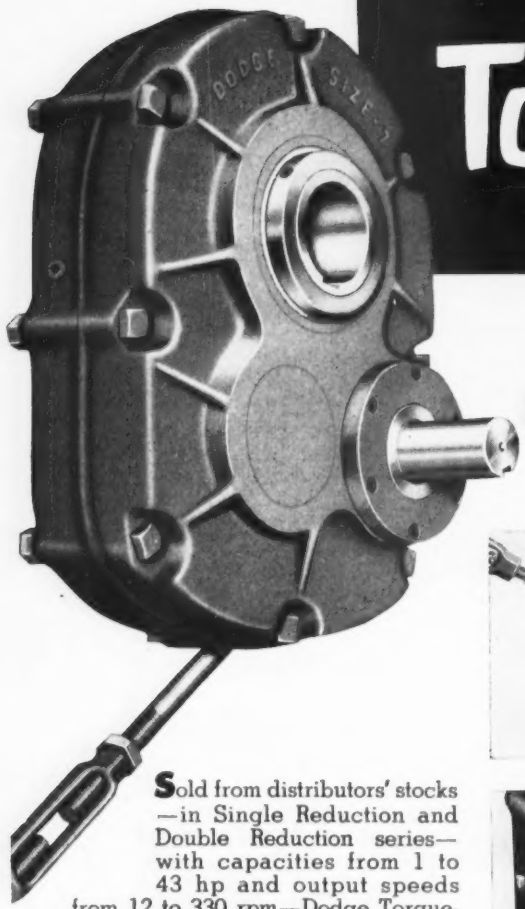

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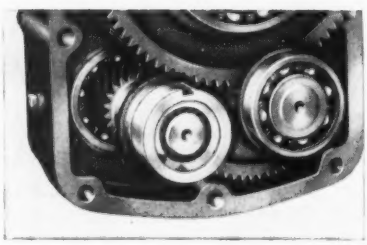
Provides instant, positive protection for driven machines, motors and reducer itself. Automatically (1) loosens the belts, (2) cuts off power, (3) gives a warning.



TORQUE-ARM BACK STOP
Available from stock when required. Easily installed—sealed inside reducer housing. Simple, positive action prevents reversal.

Sold from distributors' stocks—in Single Reduction and Double Reduction series—with capacities from 1 to 43 hp and output speeds from 12 to 330 rpm—Dodge Torque-Arm is the new and modern idea in speed reducers.

No special engineering required. No foundation to provide. No flexible couplings. No sliding base. No lining up difficulties. No expensive installation. Stock Taper-Lock sheaves prescribed for each job to provide desired speeds. Application to other machines is practical and easy.

Unit is driven through any V-Belt Drive. Torque-Arm, fastened to any fixed object, anchors the reducer unit. Turnbuckle provides fast and accurate adjustment of belt tension.

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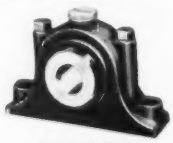
DODGE-TIMKEN PILLOW BLOCKS

TAPER-LOCK FLEXIBLE COUPLINGS

users specify AMSCO DREDGE PUMPS

More **Amsco** Pumps have been placed in dredges for sand and gravel recovery, river and harbor dredging, shell reclamation, and more recently, ores such as titanium, than those of any other manufacturer. The reasons for this preference are clear:

Amsco Pumps, with working parts made of manganese steel, can withstand the terrific abrasion of sand and the sledge hammer blows of rock much longer than any others.

Amsco Pumps are designed from experience and engineered for your job.

▶These six basic types of Amsco Dredge Pumps—actually there are 40 different models—give a general idea of the complete line. The basic differences are in rated capacity, weight and construction of bearings, and in proportionate shaft sizes. Such modifications are made for economy...There is no dollar-wasting excess weight on the Amsco Pump engineered for your job. Water end parts are also available in ABK metal subject to our engineers approval.

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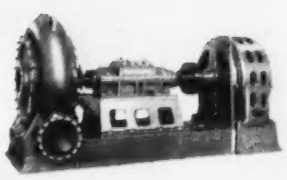
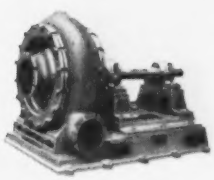
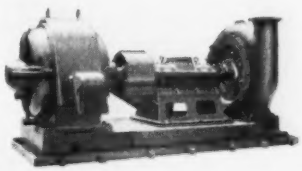


16-inch type XH—directly connected design; right hand bottom discharge. Can be fitted with "standard" or "counter-flow" water ends.

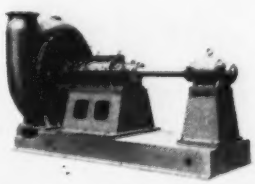


6-inch type SB-CF, form 24—antifriction bearing, stub base or belt driven; right hand bottom discharge.

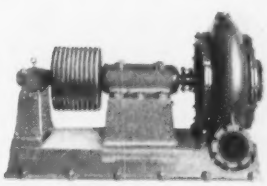


10-inch type M—left hand top discharge. Built in 6-, 8- and 10-inch sizes. Can be fitted with "standard" or "counter-flow" water ends.

20-inch type XHRB-CF—left hand bottom discharge; antifriction thrust and radial bearings.



12-inch type H-CF, form 40—right hand, top vertical discharge; belt driven. Combination two directional type ball thrust bearing and sleeve-type radial bearings



8-inch type C, form 30—belt driven; left hand bottom discharge; combination ball thrust and ring oiling sleeve main bearings. Available with "standard" or "counter-flow" water ends.

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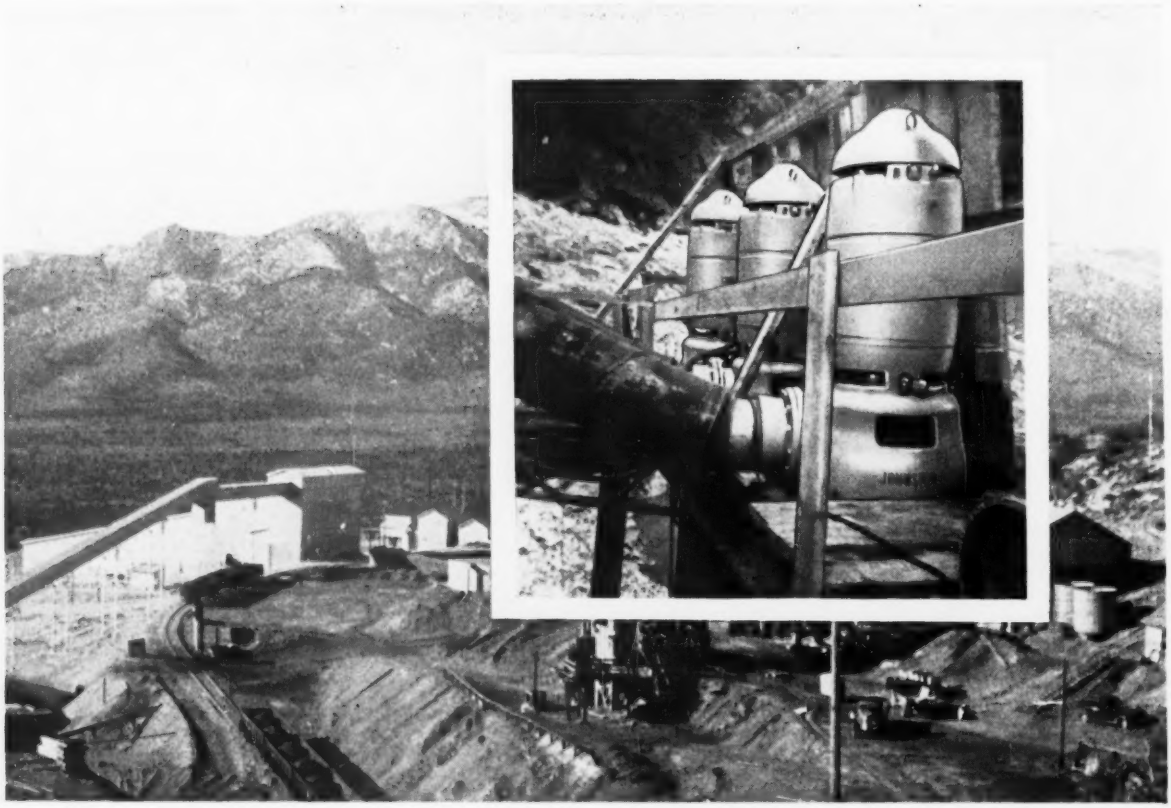
In Mine after Mine...



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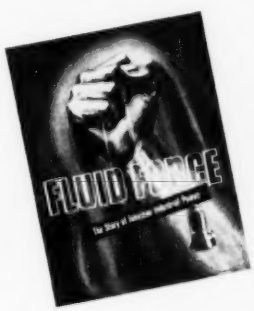
In North and South America . . . In Africa and Asia . . . Everywhere, in fact, Johnston Pumps are PROVING themselves to operators who demand IN-THE-MINE PERFORMANCE that backs up selling claims based on laboratory tests.

Johnston Mine Pumps are operating at pressures as great as 600 P.S.I.—handling fluids as hot as 250°F.—pumping corrosive and abrasive water in large and small quantities—and they are doing it week after week, year after year, at higher sustained efficiencies, with lower maintenance costs, no matter what the conditions.

If you have a mine or mill pumping job on your hands that is proving costly to handle, Johnston can offer you some relief. In any event, it won't cost you a dime to get the suggestions of trained Johnston hydraulic engineers with specialized experience in the mining field.



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GM DIESEL CASE HISTORY No. 5012-7

USER: The John T. Dyer Quarry Co., Birdsboro, Pa., producers of trap rock.

INSTALLATION: GM 4-71 Diesels powering 11 Koehring Dumptors. Six purchased in 1946, three more in 1948 and two in 1950. Dumptors gradually replaced railroad as quarry deepened and haul grades became too steep.

PERFORMANCE: Dumptors keep crusher operating at peak capacity 10 hours a day. Easily negotiate 7% grade with 7½-ton load on 1400' haul. Engines have operated dependably with time out only for normal maintenance.

THIS DIESEL GETS UP GRADES FASTER

... and keeps coming back for more

"One GM Diesel leads to another." That's what many owners say when talking about GM Diesel performance. For General Motors Diesel engines are built to get more work done at lower cost. Two-cycle operation gives them faster acceleration, better grade-climbing ability, quicker response under load. Blower scavenging permits high altitude operation with maximum efficiency. Simplified design puts accessories where they are easy to inspect and service. Volume production and interchangeability insure lower cost parts, minimum maintenance expense. Check it with GM Diesel owners. Then specify GM Diesel power for your equipment. You will find that—

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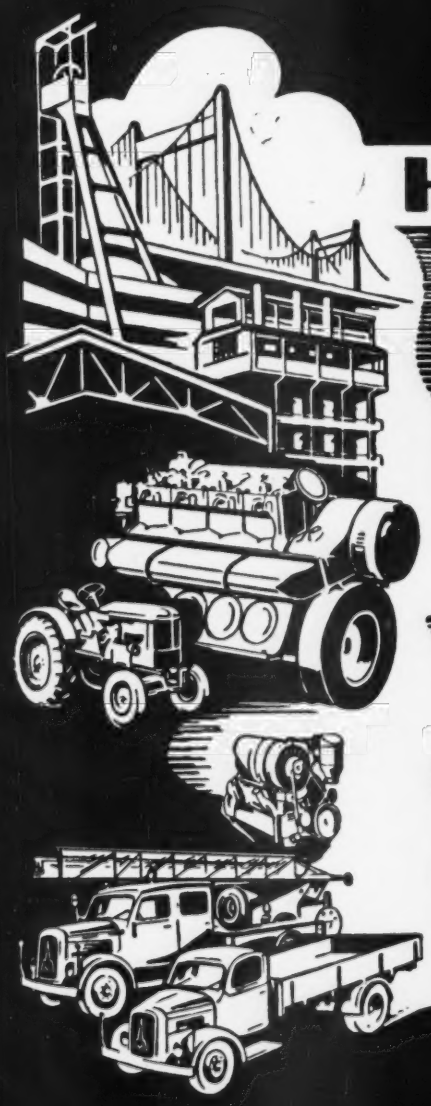

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It's cohesive... economical... efficient

Many ore miners specify Du Pont "Gelex" because it gives maximum efficiency at lowest cost in a wide variety of mining operations.

In upward-pitching holes "Gelex" is plastic enough to stay put and cohesive enough to eliminate raveling. Its excellent water resistance often permits substitution for more expensive gelatins. It gives good fragmentation and has excellent fumes.

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Deliver Higher Efficiency and Economy

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SUPERLATIVE PERFORMANCE of Sheffield Moly-Cop grinding balls is the result of years of research, and quality-controlled methods of manufacture—from initial alloy steel production to final heat treatment.

LET SHEFFIELD prove how Moly-Cop Grinding Balls will do a better job for you.

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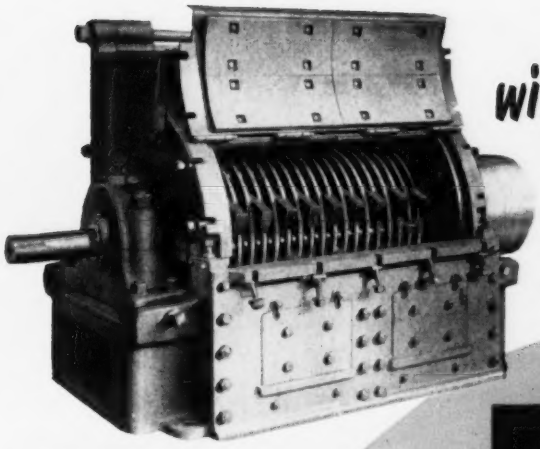
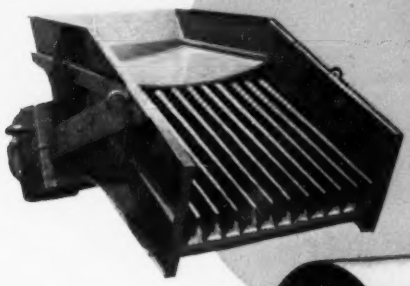
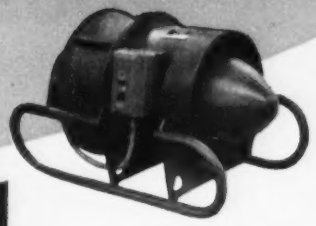


CRUSHERS— The Jeffrey **Type B Swing** Hammer Crusher for severe duty. **Being used** successfully on limestone, shale, slate, clay, chalk, marl, gypsum, phosphate rock and asbestos rock. Shown is a 36" x 24" unit.

Jeffrey equipment for metal mine operation has gained a favorable reputation for ruggedness, versatility and economy over many years of service to the industry.

Thus, through the medium of modern, cost-saving, quality equipment, a host of metal mine operators are mechanizing for profit.



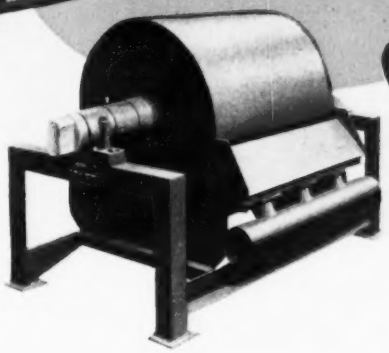


BLOWERS

5 H.P. units for use with tubing for auxiliary ventilation inside the mine. Volume — 6200 C.F.M. free delivery. Non-overloading. Induction Motor — 3450 R.P.M. In open or permissible equipment.

VIBRATING FEEDERS

The Grizzly Feeder shown provides both a feed and non-clogging grizzly in a single unit — is extremely flexible — handles large tonnages. Also Pan Feeders.



MAGNETIC SEPARATORS

Type CO Magnetic Separator shown is designed for recovery of magnetic medium in a standard Heavy Media plant. Separators are of the drum type, have the advantages of extreme simplicity — high capacity — minimum supervision. Bulletin No. 846.

THE JEFFREY MANUFACTURING CO.

ESTABLISHED 1877

Columbus 16, Ohio

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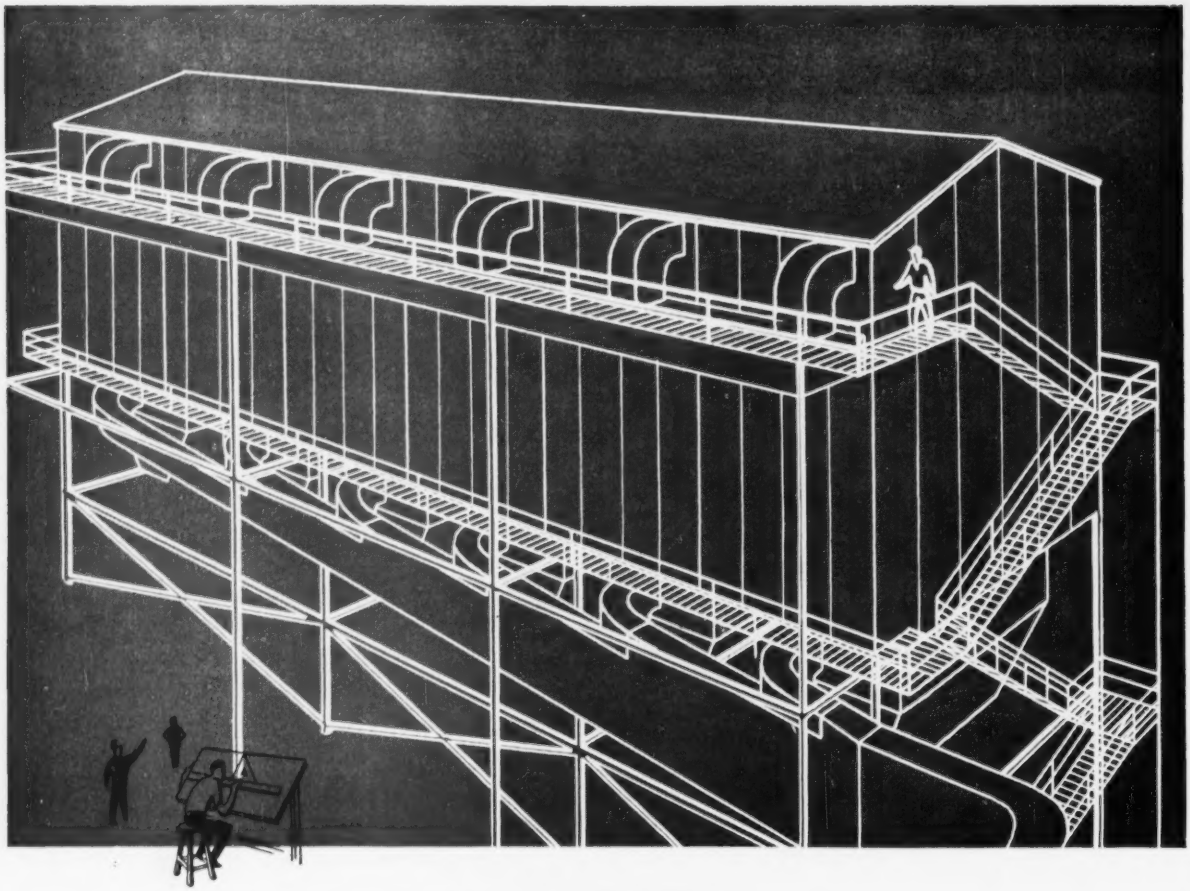
PLANTS IN CANADA, ENGLAND, SOUTH AFRICA

IF IT'S MINED, PROCESSED OR MOVED
. . .IT'S A JOB FOR JEFFREY!



DUSTUBE... custom designed

for the mining and metallurgical industry

Dustube Collectors are individually designed for the rigorous dust and fume applications of the mining and metallurgical industry. They have the inherent capacity for continuous, severe service at high filtration efficiency, with a minimum of down time for maintenance. Uniform recoveries approaching 100% are commonplace. Hot and/or corrosive gases are efficiently handled through the use of synthetic filtration fabrics. Automatic units can be designed to permit interior inspection and maintenance of the Dustube without shutting down.

Dustubes can be custom designed to readily fit existing or new plant buildings flue lines and ground contours. Various arrangements of hoppers and hopper discharge mechanisms are available — including steep-sloped pyramid hoppers with rotary, double-dribble or slide gate valves; trough type hoppers with screw conveyors, or flat-bottom hoppers with built-in scraper conveyors.

All collected fume or dust is automatically conveyed to one central point, thus eliminating expensive hand labor in handling valuable by-products. Collected materials may be reprocessed without dewatering, filtering or drying.

Our engineers are at your service to assist you in your filtration problems. It will pay you to investigate the many advantages of Dustube Collectors. *Write for complete information today.*

TYPICAL APPLICATIONS

Lead blast furnace gases
Zinc fuming retorts and sinter fumes
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Reverberatory lead furnace fumes
Dwight-Lloyd sinter fumes
Filtration of furnace gases

American dustube® COLLECTORS

WHEELABRATOR & EQUIPMENT CORP.

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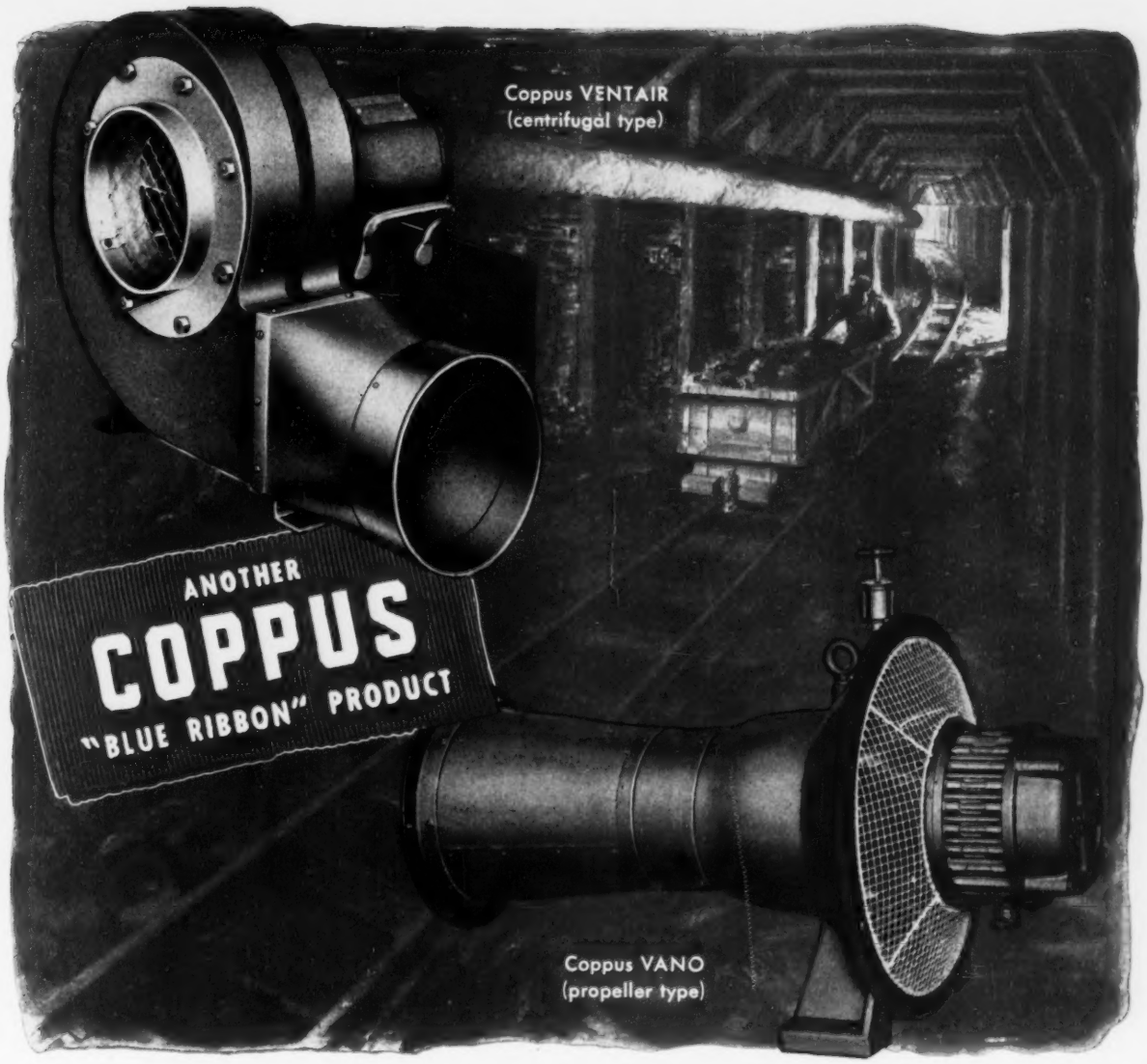


Two Blowers . . . One Purpose: 30 to 100% More Air

Why two totally different blower types? Because the requirements of mine ventilation fall into two entirely different categories.

For high pressures, long pipe lines, use the Coppus VENTAIR® (centrifugal type). For medium pressures, shorter pipe lines, the Coppus VANO® (propeller type) is best. One or the other will give you more air per given power consumption than other blowers — from 30% to 100% more. Can be used as blowers or exhausters, capacities up to 90,000 CFM, with compressed air or electric motor drive.

Only Coppus makes both types. And, for quick recognition, each wears the famous "Blue Ribbon", distinguishing mark of top-quality engineering, materials and performance. This blue band is your guarantee of better mine ventilation . . . Look for it.

Representatives listed in MINING CATALOGS. Other Coppus "Blue Ribbon" products: steam turbines, gas burners, heat killers, air filters, blowers and exhausters for special purposes. See also THOMAS' REGISTER . . . Coppus Engineering Corporation, Worcester 2, Mass.

COPPUS ENGINEERING CORPORATION
283 Park Avenue, Worcester 2, Mass.

Please send: Bulletin 130.

Name .....

Company .....

Address .....

Portable drainage ditch for a Sunken Roadbed

● The rock floor of this limestone quarry, nearly a hundred feet below ground level, presents a constant drainage problem.

Men and equipment must be free to work around the clock in any kind of weather . . . free to work despite rain squalls, spring thaws or the gradual seepage of surface water through the overburden.

And, since the work location shifts as each load of stone is removed, the drainage facilities must be able to move with the shovels.

Getting the water off is a job for hose . . . a tough, flexible water carrier that can be dragged over abrasive surfaces, subjected to falling rock, snaked into out-of-the-way crevices and lengthened or shortened at the turn of a coupling.

The Bessemer Limestone Company, a Republic Rubber customer for more than a generation, uses Republic's Water Hose for this purpose.

They use Republic Hose because it stands up better, handles easier, lasts longer on the job.

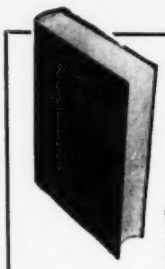
Water Hose is just one of Republic's complete line of Industrial Rubber Products that is quality built and sold through Republic Distributors who are experts in their job of helping you select and apply the right hose or belt for your specific job.

Your Republic Distributor is ready to make a complete, free analysis of your requirements now. Contact him or write us today for full facts on how this analysis results in better performance, better service and less costs for you on the job.

REPUBLIC RUBBER DIVISION

LEE RUBBER & TIRE CORPORATION, YOUNGSTOWN 1, OHIO

INDUSTRIAL RUBBER PRODUCTS



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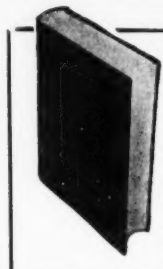

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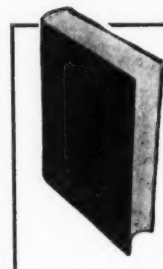

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A well-known manual that, step-by-step and clearly, shows you how to write technical reports that are easy to read and understand—reports that win acceptance of your ideas. Tells you how to analyze the type of report, how to choose the best form and style, how to organize the material, and how to use figures, tables, and annotations. **By J. Raleigh Nelson, Prof. Emeritus of English in the Coll. of Engr., Univ. of Mich. Third Edition, 356 pages, $4.50**

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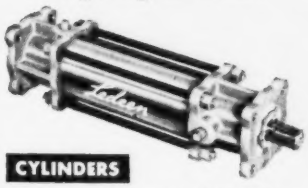

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For air, oil, water, gas or steam operation—in standard and special diameters and stroke lengths.

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VALVES

For operating air and hydraulic cylinders and motors, single and double acting. Hand, foot, power and solenoid operated.

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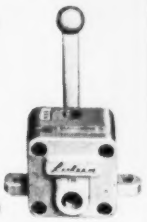

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For power operation and remote control of line valves. Adaptable to most any make, size and type of valve, to operate against any line pressure, for any fluid medium, with any pressure.

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High pressure oil, from plant air supply. For clamping, drawing, forming, testing and other operations requiring long high pressure cycles without vibration or overheating. Ready for connection to plant air and hydraulic lines.

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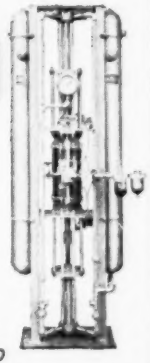

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Ledeen Mfg. Co.

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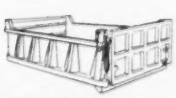
NEW HOIST RATINGS prove St.Paul best!

Tear out this ad . . . use it to compare St.Paul's "bonus capacities" with any other hoist. You'll find St.Paul gives you *far more payload capacity per lb. of weight — at all body lengths!* Your truck dealer, or St.Paul distributor will also show you why St.Paul's advanced mechanical and hydraulic improvements *mean lower installation costs, added hours of smooth, trouble-free performance.* Get the complete story on these great new St.Paul dump body hoists today, or write for free illustrated folder. St.Paul Hydraulic Hoist, Customer Service Dept., 36121 Main St., Wayne, Michigan.

St.Paul Hoist Ratings

Model	Wt. lbs.	Payload tons at body lengths shown									
		7'	8'	9'	10'	11'	12'	13'	14'	15'	16'
D-16	550	7	6								
H-16	650		9								
H-18	735			8	7	6					
H-20	795			10	9	8	7				
L-20	870			12½	11	10	9	8			
L-24	1020				12	11	10	9	8		
2 H 20	1370				17½	15½	14	13	12	11	10
2 L 20	1555				22½	20	18	16	15	14	13
2 L 24	1695				27½	24½	22	20	18	17	16

...also check St.Paul's complete new line of matching dump bodies



MODEL 301 Triple-strength contractor's body with pyramid side braces and boxed corner posts.

MODEL 106 Drop-side body with hinged sides and tail gate for easy hand loading with shovel.

MODEL 103 Combination dump and platform body with removable sides and corner posts.

MODEL 311 Heavy-duty rock-type body with scoop end for easy dumping of bulky loads.

OUR 41ST YEAR

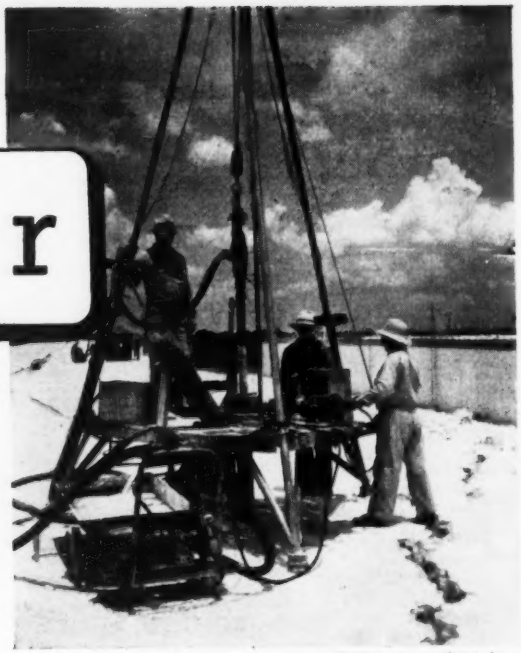
S-HBC-7

St. Paul HYDRAULIC

Hoists and Dump Bodies
Pax-all Refuse Loaders
Elevating Front Gates

oldest in reputation . . . newest in cost-saving features

Sulphur



Drilling a vat of Sulphur preparatory to blasting down

Thousands of tons mined daily, but where does it all go?

All through the open seasons—spring, summer and fall—homes everywhere are being painted, old houses as well as new getting much needed protection from the elements. It's an activity seen by millions but few realize how important Sulphur is to this phase of our domestic economy. Actually, it's an essential commodity.

That's right. Paint pigments constitute one of the largest individual consumers of Sulphur . . . in the form of sulphuric acid. Government statistics show that for the year 1950 some 1,260,000 tons of 100% H_2SO_4 were consumed by producers of lead, zinc and titanium pigments. Translated into Sulphur, this means around 400,000 long tons which is a lot of Sulphur! In fact, the pigment industry stands 5th on the list of the many industries that consume Sulphur in one form or another during their manufacturing processes.

The Sulphur Industry indeed has many mouths to feed, all important to our economy and standard of living.

Texas Gulf Sulphur Co.

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Mines: Newgulf and Moss Bluff, Texas

NEW ARITHMETIC
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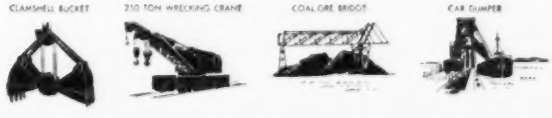
1 (SWITCH ENGINE) + 1 (LOCOMOTIVE-CRANE) = 1 BROWNHOIST DIESEL ELECTRIC LOCOMOTIVE-CRANE

Many railroads, steel mills and manufacturing plants have long been familiar with the powerful, efficient performance of Brownhoist Diesel Electric Locomotive-Cranes in handling bulk materials with magnet, hook or bucket. Brownhoist Cranes also perform equally well as switch engines because they are built with a specially designed travel generator, motor and axle reduction unit — the same equipment used in modern switching locomotives to provide high tractive power and rapid acceleration. These two dependable pieces of equipment in one husky unit mean greater versatility and economy of operation.

Brownhoist Cranes save you man hours, production time and money. The patented Monitor Type Cab and Clear-Vision Boom give the operator unlimited visibility in all directions and help him turn out a greater volume of work in less time. Sound, rugged construction plus a simplified mechanism and easy accessibility to all moving parts help keep maintenance and repair costs low.

Brownhoist Cranes are built in capacities from 25 tons to 80 tons for virtually every heavy duty materials handling operation. For complete information, consult your nearest Brownhoist representative or write us today.



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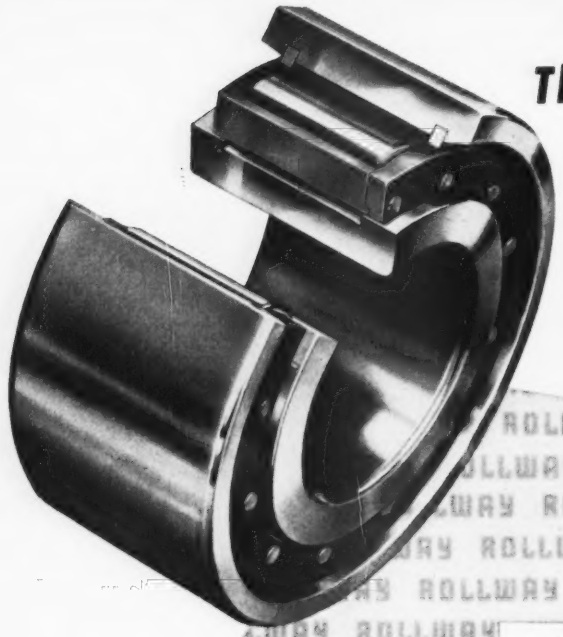
BROWNHOIST
BUILDS BETTER CRANES



There's a growing preference for ROLLWAY BEARINGS

...and with good reason!

Unwavering right-line rotation—free of skew, side-shock and end-rub—greatly extends the life expectancy of a Rollway Roller Bearing. Add to longer life the definite gains in smoother operation and lower maintenance costs and it's understandable why, today, demand for Rollways has reached a new peak.

Our increased facilities are expanding Rollway output as fast as possible. We are continuing to improve the balance between supply and demand, so that service to both established and new customers will be geared to their quantity requirements . . . another reason why bearing users can confidently specify "The bearings that *roll* right because they're *made* right."

Our complete engineering and metallurgical services will gladly work with you on your problems. Simply write or wire any sales office. No cost. No obligation.

Rollway Bearing replacements are available through authorized bearing distributors in principal cities. Consult your classified 'phone directory.

ROLLWAY BEARING CO., INC.
SYRACUSE 4, N. Y.

RIGHT ANGLE

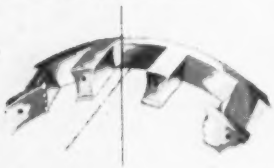
ROLLER ENDS, precisely square to avoid end-rub, oscillation and side-shock.

RIGHT ANGLE

BEARING SURFACES with parallelism that results in unwavering right-line rolling.

RIGHT ANGLE

SEPARATOR SLOTS accurately machined to prevent roller skew, slide and uneven wear.



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Complete Line of Radial and Thrust Cylindrical Roller Bearings

FIGHTS THE STEEL

...not the MAN

Smoothly-balanced Gardner-Denver Stopers are easy to handle — even in tight stopes or from temporary staging — let your runners concentrate on greater footage. Full information in Bulletin SD-2.

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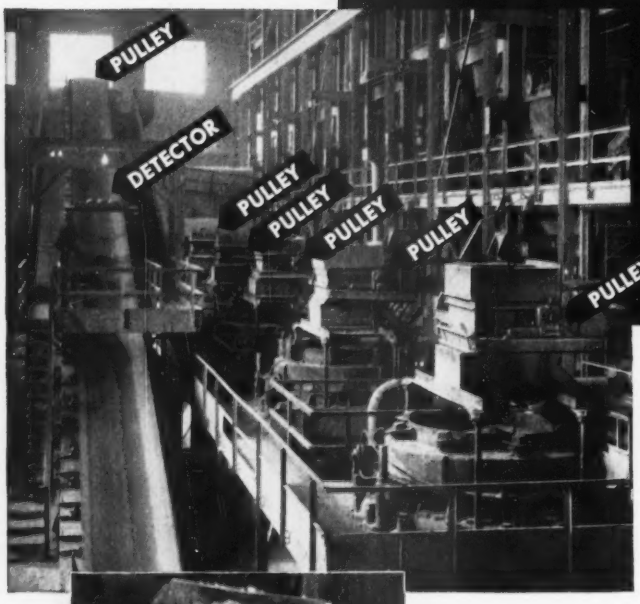
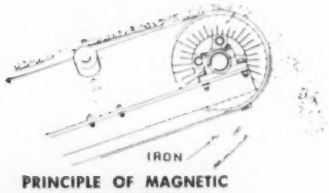
THE QUALITY LEADER IN COMPRESSORS, PUMPS AND ROCK DRILLS

TRAMP IRON can't beat the Brains Brawn of this DINGS Iron Detector Magnetic Pulley Team

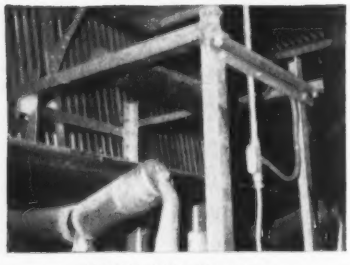


In this ore preparation plant—Quick acting Dings electronic Iron Detector checks main belt burden for large, unwieldy iron rods, rails, chunks—stops belt instantly for their removal. Then Dings Magnetic Pulleys take over the crusher protection job.

DINGS ELECTRO-PULLEY OVER CRUSHER HOPPER



PRINCIPLE OF MAGNETIC PULLEY OPERATION



DINGS IRON DETECTOR

POWERFUL DINGS ELECTRO-PULLEYS . . . give fully automatic iron removal—have virtually unlimited life when given minimum attention. These units have the extra depth of magnetic field, required for heavier belt burdens—but cost very little to operate.

Installation as head pulleys in conveyor systems is usually simple—the Dings pulley shaft is machined to the dimensions of that of the pulley being replaced and the same bearings are used. Little wiring is required.

Dings air-cooled design provides cooler, more economical operation and longer life. Separate section construction plus bronze coil covers make possible the most efficient distribution, greatest penetration of magnetic field. And Dings coil winding process virtually eliminates the possibility of electrical breakdown. Get capacities and dimensions in Catalog C-1001-A.

Alone or in combination Dings Magnets are your best protection against tramp iron—for a look at the complete Dings line send for Catalog C-5000-B.

DINGS MAGNETIC SEPARATOR CO.
4716 W. Electric Ave., Milwaukee 46, Wis.

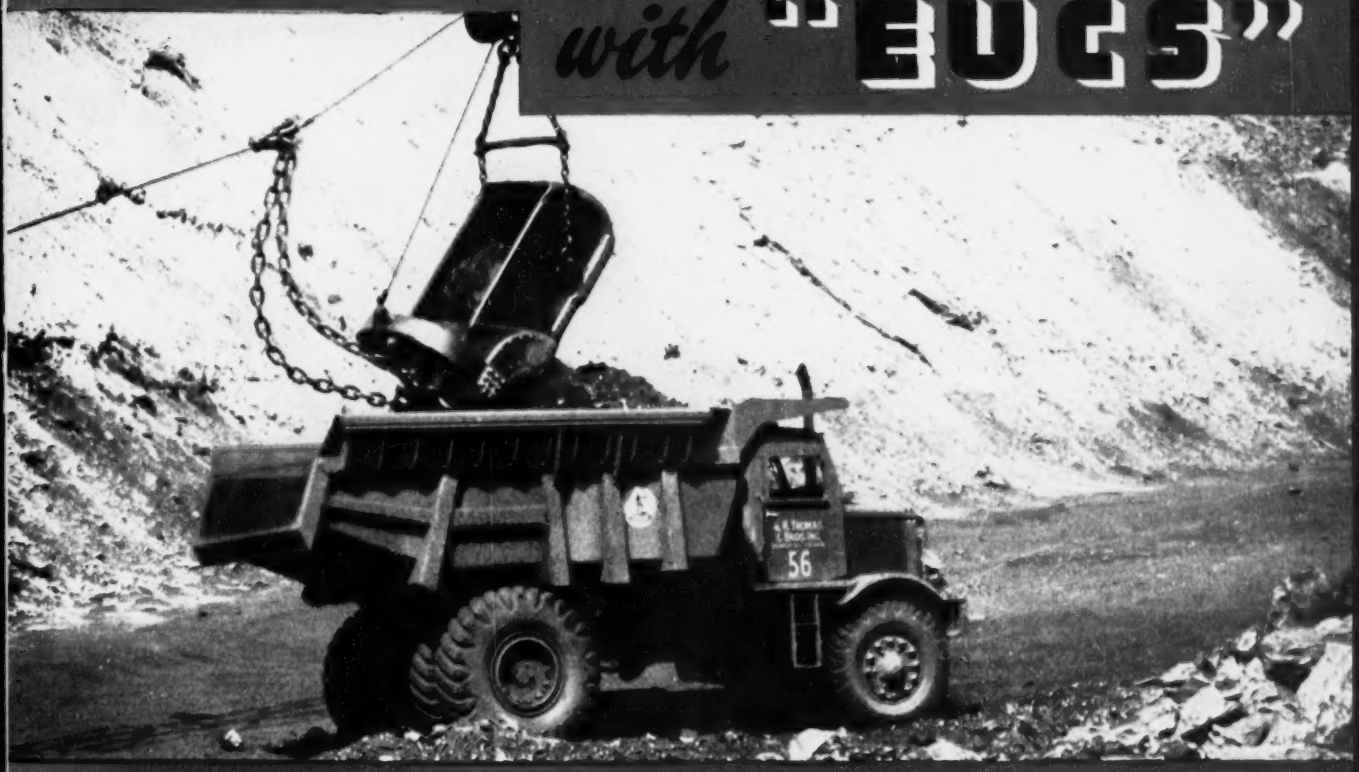
DINGS RM RECTANGUAR SUSPENDED MAGNETS

DINGS MAGNETIC PULLEYS—ELECTRIC AND NON-ELECTRIC PERMANENT

DINGS NON-ELECTRIC PERMA-DRUMS

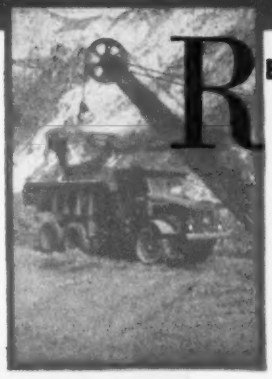
DINGS MAGNETS

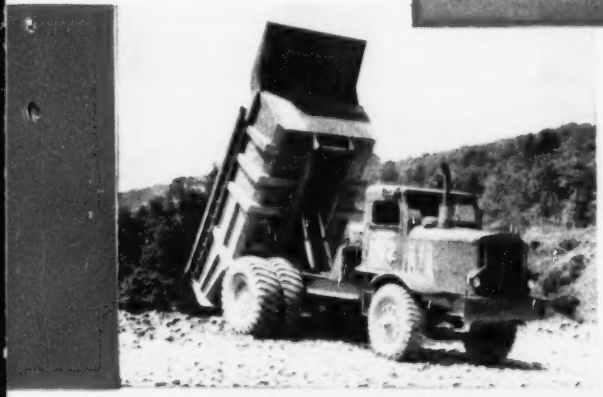
You Get Plus Performance with "EUCS"



(Above) Model TD Rear-Dump Euclid. 22 ton capacity . . . 14.8 cu. yds. struck . . . loaded top speed 32.4 m.p.h. . . . powered by 286 or 300 h.p. diesel engine.

(Below) Double-acting twin hoists and entire hydraulic system are of Euclid design and manufacture. Action is fast and positive enabling operator to control body position at all times.





REAR-DUMP EUCLIDS are engineered and built for lasting strength. Their ability to stay on the job, day after day and year after year, means more tons moved at lower cost . . . "plus" performance for owners.

"Euc" bodies have extra thick plates reinforced with heavy box section side and bottom supports. The rugged frames are built to withstand the impacts of hauling and dumping big loads . . . they're built to take the pounding and wear of loading earth, rock and other heavy excavation by large shovels and draglines.

Rear-Dump "Eucs" have many other "plus" features that make them standard equipment in mines, quarries and on construction work. For example, they have large capacity, ample power and traction for steep grades . . . speed on the haul road and full-floating, double reduction planetary type Euclid axle.

For information on equipment that is job proved on work similar to yours, get in touch with your Euclid Distributor or write direct for literature on the complete line of Euclid models.

The EUCLID ROAD MACHINERY Co., CLEVELAND 17, OHIO

EUCLIDS *Move the Earth*

Collyer

PORTABLE CABLES OF PROVEN QUALITY

May we quote on your requirements? Send for prices, samples, recommendations — or ask for new Bulletin 152 describing complete line of Collyer Portable Power Cables. Collyer Insulated Wire Co., 245 Roosevelt Ave., Pawtucket, Rhode Island.

there is NO substitute . . .

MPC WOOD-LINED PIPE MEETS ALL THE REQUIREMENTS FOR A DEPENDABLE MINE PIPE

COMBINES THE STRENGTH OF STEEL WITH THE DURABILITY OF WOOD

MPC Wood-Lined Steel pipe is ideally suited for acid mine waters, culm, and slurries to pressures up to 400 psi. The wood lining, made of clear redwood, Douglas fir, or pine staves, is offered in thicknesses from 11/16" through 3", while the outer carbon steel shell is available from 14 gauge through schedule 80 thickness. Flanges, welded to the pipe, carry ratings of 125 lb. upwards, with A.S.M.E. bolt circle or special drilling. Pipe sections 10' and 20' regular lengths or fabricated to suit. Internal diameters 4" through 48". Pipe exteriors protected against corrosion. Wood-lined fittings available for all diameters in standard and special designs.

Get in touch with your MPC representative or write Dept. E.M.J.

EST. mpc 1869

MICHIGAN PIPE COMPANY

BAY CITY, MICHIGAN

250 feet long and weighing 421,000 lbs., this huge 14-unit PIONEER Rock Crushing plant is the biggest of its kind ever built. It consists of a jaw crusher, 3 roll crushers, washing unit, dehydrator, and a number of feeders, conveyors and screens arranged in sequence to provide a plant capable of meeting strict defense requirements for producing specification aggregates from any suitable material found anywhere on the globe.

Last September, when this picture was taken, 35 experts from defense headquarters in the U. S. and Canada had come to Minneapolis to see this giant plant turn out 200 tons of washed material per hour. Similar PIONEER plants are now in operation on every continent, doing their part to protect free nations from aggression.

Big

Big . . .

That's a handy word when you talk about PIONEER.

Big machinery . . . *big* jobs . . . *big* ideas.

Construction and mining people all over the world look to Minneapolis when they have *big* problems to solve.

The government, for instance, asked PIONEER to design and deliver 100 giant rock crushing plants like the one shown above . . . the biggest plants of their kind ever built!

But PIONEER hasn't built its world reputation on bigness alone. The inspiration of its engineers and designers . . . the skilled craftsmanship of its hardy northern workers . . . the know-how of its management . . . all these go to make PIONEER equipment the sturdiest and most efficient anywhere obtainable.

Today, PIONEER-built equipment is needed more than ever before. Night or day you'll find things humming at the PIONEER factory. Complete crushing plants, feeders, conveyors, screens, jaw crushers, roll crushers, washing plants, bituminous mixing plants, and bituminous pavers are some of the more important items coming off the PIONEER production line.

With highway and mine construction setting new records, PIONEER will play an important part in building America's future. And as a part of America's Free Enterprise System, it expects that future to be BIG.

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Jones

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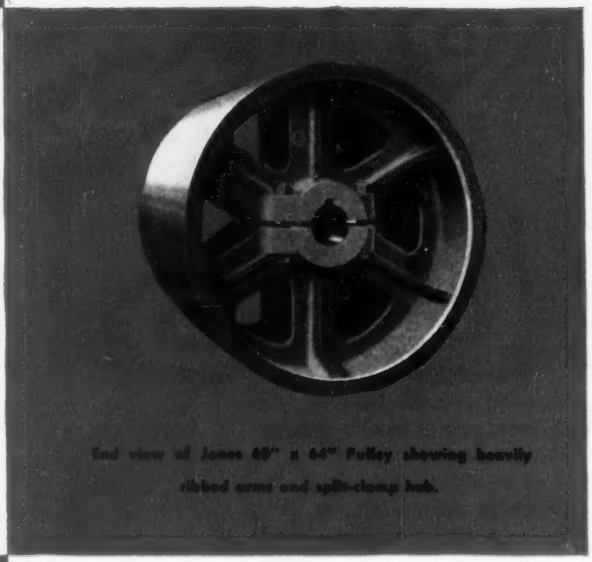
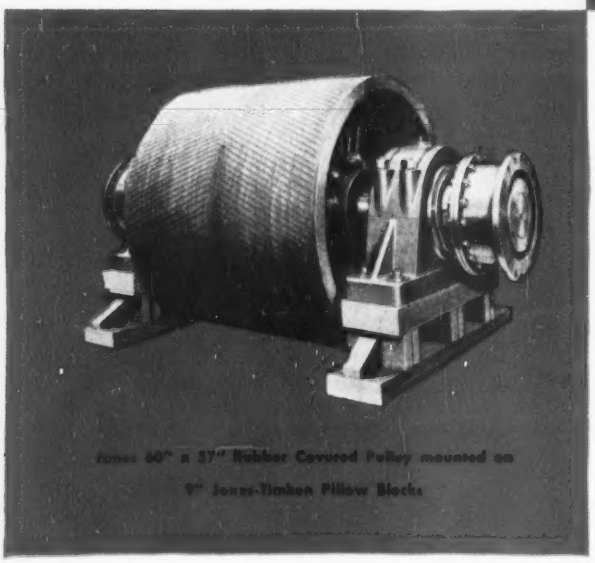
- Tailor-made to meet your requirements in standardized designs for belt tensions up to 1500 pounds per inch of face.
- Mounted on shafts with Jones-Timken pillow blocks and couplings factory assembled to simplify field erection.
- Drive Pulleys with plain or grooved lagging.



End view of Jones 60" x 64" Pulley showing heavily ribbed arms and split-clamp hub.



Jones 60" x 37" Rubber Covered Pulley mounted on 9" Jones-Timken Pillow Blocks

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- Herringbone — Worm — Worm-Helical — Spur Gear Speed Reducers • Cast Iron Pulleys • V-Belt Sheaves Timken Pillow Blocks • Flexible Couplings • Cut Gears

W. A. Jones Foundry & Machine Co.
4465 West Roosevelt Road, Chicago 24, Illinois

Since 1890 . . . In the Service of Industry

This 11½ x 12 ft. Ni-Hard Lined Rod Mill replaced 2 sets of 74" x 20" rolls with accompanying screens and conveyors for handling lead and zinc sulphide ore at the Sullivan concentrator of THE CONSOLIDATED MINING & SMELTING COMPANY OF CANADA LIMITED. (Balls placed to show size and spacing of liners are 3" in diameter.) This mill, which operates with a 76-ton charge of 3½" rods and is designed to handle 400 tons of ore per hour, is a product of the HARDINGE COMPANY, INC., York, Pa.

Four-years' service indicates 6,750,000-ton life for Ni-Hard liners in world's largest rod mill

Performance Records Prove It: NI-HARD® *provides abrasion-resistance at lowest ultimate cost...*

And the reason? With a matrix resembling that of fully hardened steel, this moderately priced nickel-chromium white cast iron is the most abrasion-resistant product of the foundry industry.

Shown in the Hardinge Rod Mill, above, are the original Ni-Hard shell and discharge end liners. The end liners are still in use and after four years of milling approximately 8,000 tons of ore per operating day, it is conservatively estimated that their total life will approximate 6,750,000 tons. The shell liners were replaced after a life of 5,700,000 tons. The probable total consumption for both shell and end liners will reach the extremely low figure of 0.010 pounds per ton.

Take steps, now, to save labor and cut maintenance as well as operating costs by using Ni-Hard for your equipment parts subject to wear and abrasion. Our wide practical experience, gained over the past 20 years in the Ni-Hard field, is available to help you determine *whether or not* Ni-Hard is the best answer to your particular needs. Send us details of your problems for our suggestions. Write us now.

At the present time, nickel is available for the production of Ni-Hard and other alloys containing nickel, for end uses in defense and defense-supporting industries. The remainder of the supply is available for some civilian applications and governmental stockpiling.

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Please send me free booklets entitled: "Engineering Properties and Applications of Ni-Hard" and "Buyers' Guide for Ni-Hard Castings."

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Sliding of basket on hanger is special feature—basket lowers onto the garment hooks, giving tamper and slip-proof suspension of clothing.

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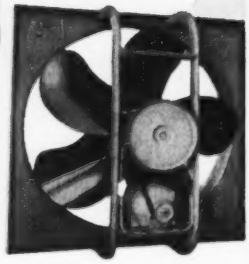

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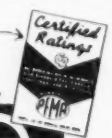

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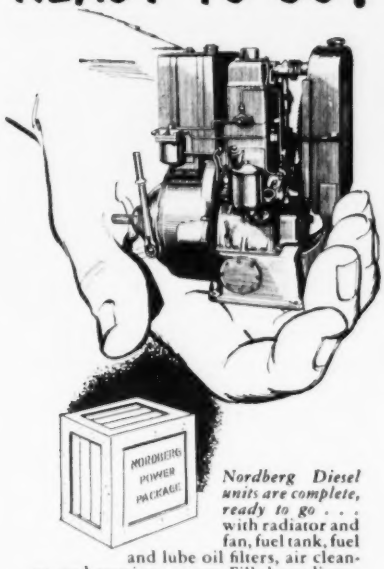

Nordberg Diesel units are complete, ready to go . . . with radiator and fan, fuel tank, fuel and lube oil filters, air cleaner, and starting system. Fill the radiator, crankcase and fuel tank and you're producing reliable, low cost power . . . for power units on shovels, for crane magnets, for pumps in mines, quarries, and irrigation, for petroleum production pumping, for auxiliary generator sets ashore and afloat, for standby lighting units in manufacturing plants—and for hundreds of other power jobs.

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Specifications:

Instrument Ranges: 5.0; 0.5; .05 MR/HR
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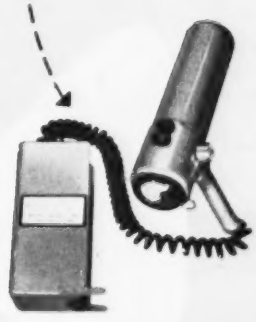
WRITE NOW FOR BULLETIN SM-205



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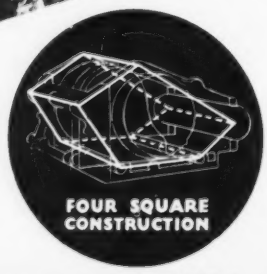
Four different sizes and H.P.'s available.

The illustrations show a PIKROSE S.3 F.L.P. Electric Scraper Hoist at work in a British Coal Mine. The machine is rated 35/75 H.P.

If required the drive can quickly and easily be interchanged for Compressed-Air usage.



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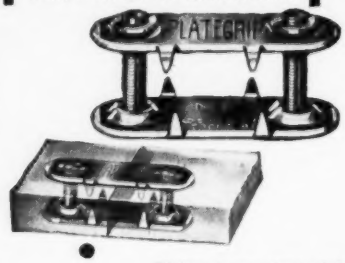
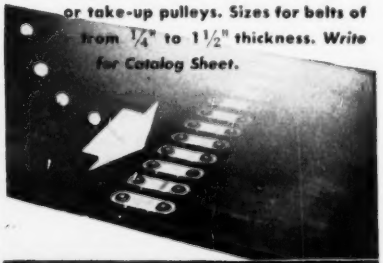
March Engr. & Mining Journal

PLATEGRIP
PLATE FASTENERS FOR CONVEYOR BELTS



- **Make strong dust-tight, water-tight joints in belts of any width. Special design spreads tension uniformly across belt, allow natural troughing of belt and assures smooth operation over flat, crowned or take-up pulleys. Sizes for belts of from ¼" to 1½" thickness. *Write for Catalog Sheet.***



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5322 Northwest Highway, CHICAGO 30, U. S. A.

Track-mounted drill with two booms makes hole-drilling and bolt-tightening swifter than ever. Bolting crews work without delay when O-B shells and plugs are used.

YOU BUY.... Speed WHEN YOU BUY O-B SHELLS AND PLUGS

O-B Expansion Shells and Plugs for ¾" bolts and threaded rods.

● That's right! Speedy roof bolt installation goes hand in hand with the use of O-B Expansion Shells and Plugs. They're the shells and plugs that are lubricated. Plug threads are always clean and rust-free, ready for assembly on the roof bolt. Shells and plugs are never rusted together.

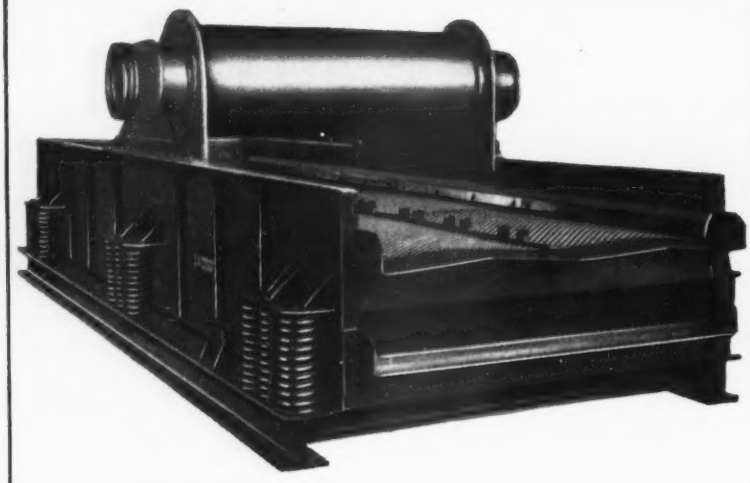
O-B shells and plugs are pre-expanded to fit bolt holes without any adjustment, with plenty of spring to hug the wall of any right-size hole. Bolts with O-B shells and plugs tighten every time!

Bolting fits right into the face working cycle when a two-man crew can set six four-foot bolts in 20 minutes! That's the kind of bolting you can do with O-B Expansion Shells and Plugs. Give them a try. You'll buy bolting speed when you buy O-B shells and plugs.

Ohio Brass

MANSFIELD OHIO, U. S. A.

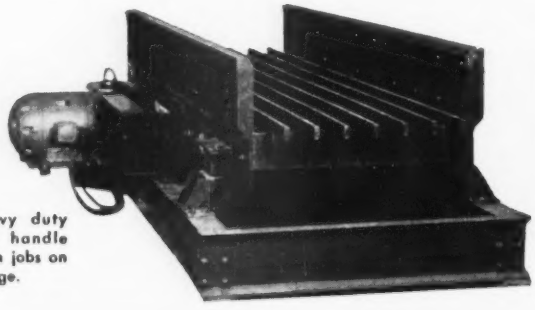
4335-M



SIMPLICITY gyrating screens are doing a fast, efficient sizing and dewatering job for the metal mining industry

The 6′ x 20′ Simplicity Model OM Double Deck Screen shown here is typical of Simplicity Screens used successfully at the great Mesabi Range in Minnesota to size and dewater iron ore. This screen, with a ⅜″ opening on the top deck and a 1½mm. dewatering surface on the lower deck, is designed for heavy media concentration of iron ore.

Throughout the metal mining industry, Simplicity equipment is handling all types of preparation work from coarse scalping to fine screening and dewatering. Simplicity operating mechanism insures fast, accurate sizing and keeps production costs down.



Simplicity heavy duty scalpers also handle tough production jobs on the Mesabi Range.

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113

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THE MAN WE MEAN IS A COMPOSITE of the editorial staff of this magazine. For, obviously, no one individual could ever accomplish such a vast business news job. It's the result of many qualified men of diversified and specialized talents.

AND, THERE'S ANOTHER SIDE TO THIS "COMPOSITE MAN," another complete news service which complements the editorial section of this magazine — the advertising pages. It's been said that in a business publication the editorial pages tell "how they do it" — "they" being all the industry's front line of innovators and improvers—and the advertising pages tell "with what." Each issue unfolds an industrial exposition before you — giving a ready panorama of up-to-date tools, materials, equipment.

SUCH A "MAN" IS ON YOUR PAYROLL. Be sure to "listen" regularly and carefully to the practical business information he gathers.

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Thermoid's long experience and continuing research *in the field*, pays off with real economy, maximum efficiency and greater tonnage for your belting dollar. Regardless of the size or kind of material—light or heavy, soft or abrasive, hot or cold, wet or dry—whatever the job, it's a good bet that Thermoid has solved the same or a similar problem with a belt that will do the job better.

In most cases, your Thermoid distributor can select the belt that will serve your needs most economically. Where unusual conditions exist, he will call in an experienced Thermoid sales engineer.

Get in touch with your Thermoid distributor or write direct for a copy of the Thermoid Conveyor Belting Catalog No. 3679.

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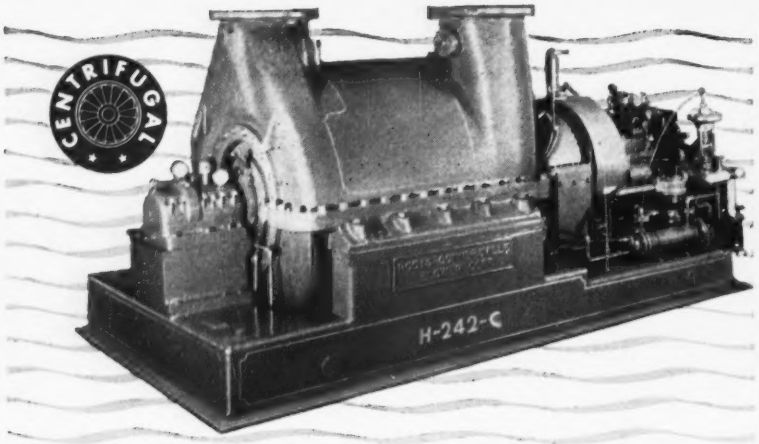

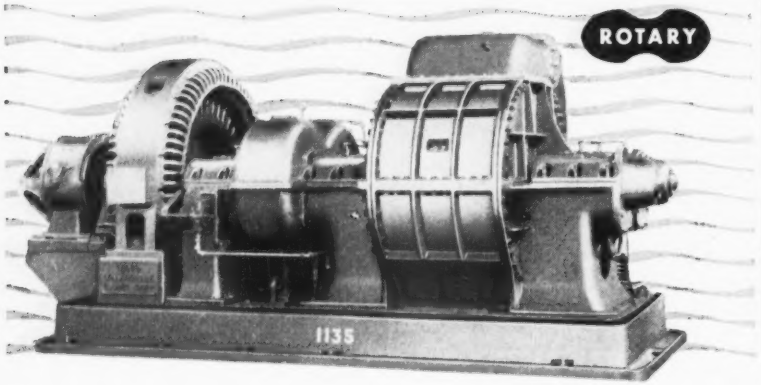

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DINGS POCKET-SIZED MAGNETIC EXTRACTOR SAVES TIME, MONEY AND LABOR . . .

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Try one—just $10.00 for the 1¼" diameter Extractor, $12.00 for the 1⅝", $20.00 for the 2⅛". Money back in 30 days if you're not satisfied. Send order to Dings Magnetic Separator Co., 4716 W. Electric Ave., Milwaukee 46, Wis.

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Engineering and Mining Journal

One of a series of ads prepared by
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LOADING — High reverse speeds, power steering and high lift make the Model HM flexible and fast for loading operations with output between 100 and 150 cu. yds. per hour.

STRIPPING — The ability of the Model HM to dig *and* load enables it to strip overburden and load it too when advisable. Precise bucket control also insures a close, clean stripping job.

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MASTER OF MANY JOBS

The big Model HM "PAYLOADER" tractor-shovel is popular at pits, quarries, mines and plants because it is both capable *and* versatile . . . is able to do many jobs and move quickly from place to place at speeds of 17 m.p.h. Big tires, plus 4-wheel drive, gives it catlike traction over rock, dirt and sand. Power-boosted rear wheel steering makes it maneuverable and easy to handle . . . 4 gear ratios in each direction provide the right speeds to fit each task.

The powerful 1½ cu. yd. "PAYLOADER" is the flagship of the "PAYLOADER" fleet, which includes 7 sizes down to 12 cu. ft. bucket capacity. Also a choice of 4 wheel drive, rear wheel drive and front wheel drive to best fit your needs. Your Hough Distributor, one of 200 in the U.S. and Canada, is ready to serve you *right* — with extensive application experience and complete parts and service facilities. The Frank G. Hough Co., 726 Sunnyside Ave., Libertyville, Ill.

WRITE for full information on any of the "PAYLOADER" models: FourWheel Drive HM — 1½ yd. and HR — 1 yd.; Rear Wheel Drive Models HY — 1¼ yd., HF — ¾ yd., HE — ½ yd.; Front wheel drive Models HAH — 15 cu. ft., HA — 12 cu. ft.

SAY "HUFF"

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- McCARTHY DRILLS PAY THEIR WAY
- MAKE MORE MONEY FOR YOU
- RECORDS SHOW 40% MORE HOLES
- LIST OF USERS ON REQUEST

Heavy Powerful Rugged

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At an open-cut mine in Muswellbrook, Australia, Theiss Bros. Proprietary Ltd., was confronted with a difficult blast hole drilling problem. Shot holes for overburden removal had to go through hard slate and conglomerate. In spite of these unusual conditions Theiss Bros. averaged 300 feet of 6- to 8-inch holes per day using a truck-mounted McCarthy Vertical Blast Hole Drill. They say there's nothing better. Holes averaged 16 feet deep, but in some cases reached 46 feet. For further information on this rugged, dependable drill write Salem Tool Company and a representative will call on you.

At the famous Jurassic iron ore system in England, heavy limestone has been encountered under soil and boulder clay before reaching the ironstone. The 20-ft. slab of limestone is broken up for the dragline by the dependable McCarthy Horizontal Blast Hole Drill. Highwall is protected and left virtually intact by buffer blasting. Blast holes are drilled 80 feet deep with explosive charges being placed in the back 50 feet. Space behind the open cast gelignite is stemmed with sand. The McCarthy Blast Hole Drill is specially mounted on a shovel for faster positioning up along the wall. Three tons of explosives are usually detonated in one blast. McCarthy Auger Drills are in use all over the world for many purposes. Write Salem Tool Company direct and our representative will call on you.

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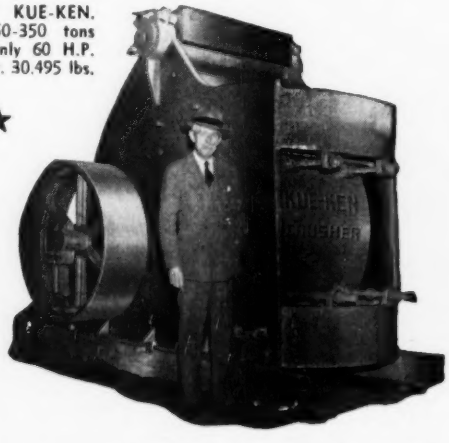

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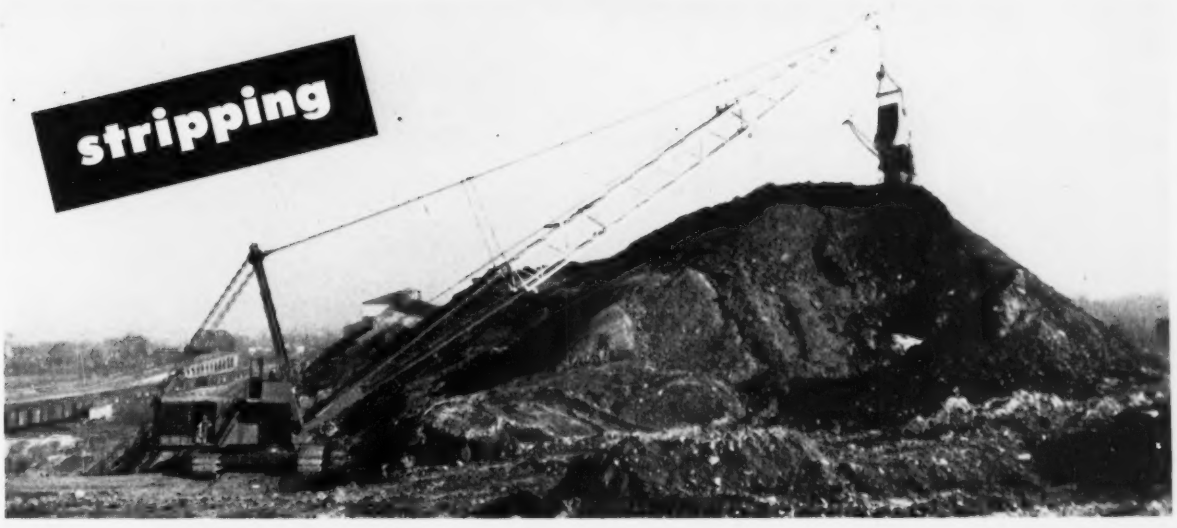

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Lorains are not strangers to Dulin Bauxite. Here's proof in the words of Vice President L. D. Riffe, "The company now owns 4 Lorains and we have been highly pleased with their performance over a period of several years." Pictures of 2 of their Lorains are shown at right.

The features that insure such Lorain performance are many. Experienced shovel men like the fast, snappy action for big production. They like the ample power to get heaping bucket loads. They like the smooth, handling ease that adds to yardage and lessens operator fatigue. Best of all, mining men have seen Lorains on the job for years—some as many as 30 and 35—they know there's quality that safeguards their investment.

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This is a close-up of the Dulin husky 1-yd. Lorain 50-I loading bauxite.

Here's the popular Lorain TL25-K working in the Dixon Pit of the Dulin Bauxite Co. near Sweet Home, Arkansas. This ¾-yd. shovel features fast, snappy digging.

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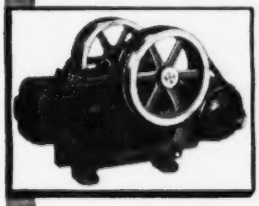

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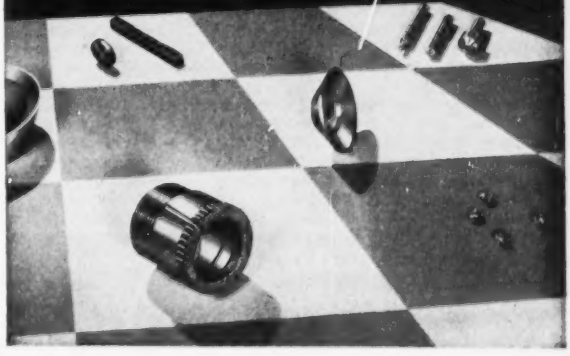

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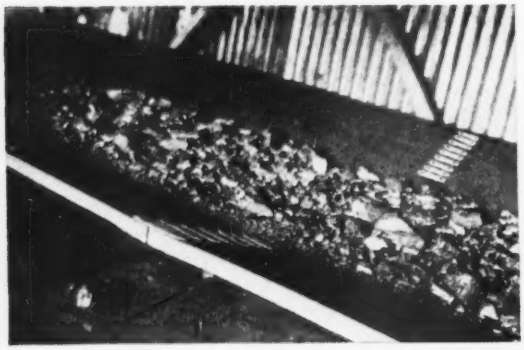

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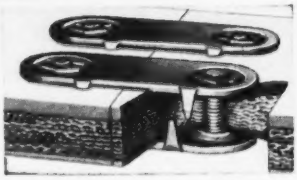

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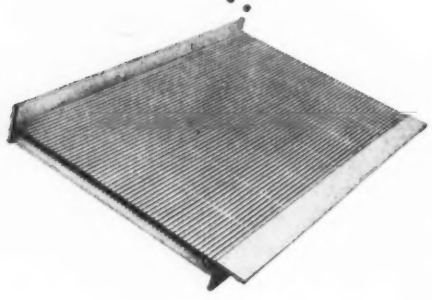

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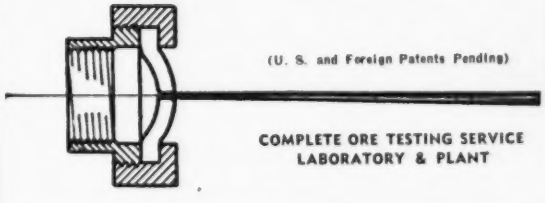

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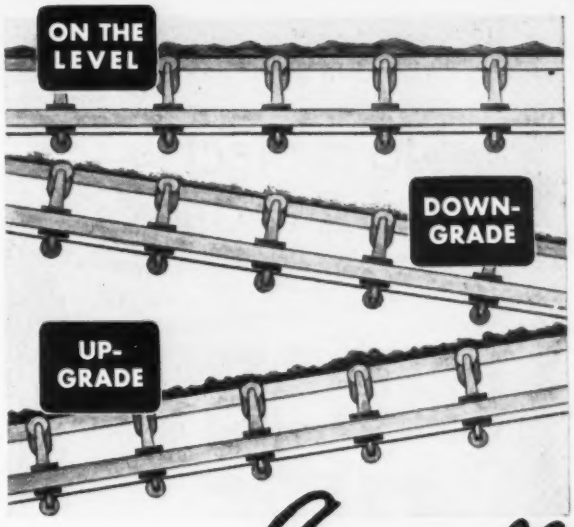

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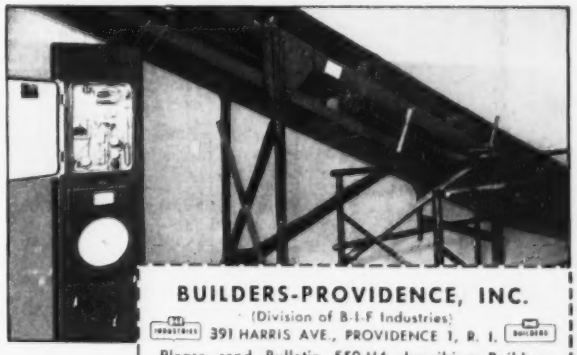

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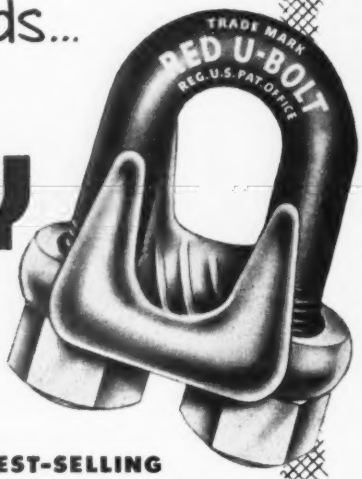

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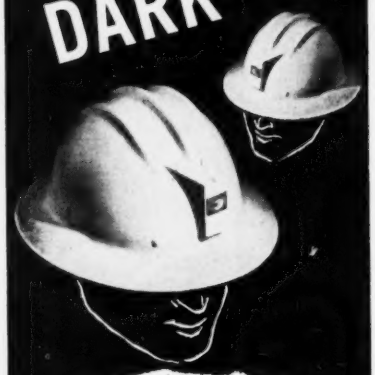

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With experience in concrete or mill construction large Copper Company Chile, South America. 3-year contract. Transportation both ways and salary while traveling paid by Company. In reply give complete details. **P6910 Engineering & Mining Journal, 330 W. 42 St., New York 36, N. Y.**

POSITIONS VACANT

CHIEF CHEMIST: Qualified to supervise good volume of routine determinations on ores, concentrates, mill products. Must be able to train and check native technicians also organize efficient handling by modern methods. Knowledge of sampling methods desirable. P-6625, Engineering & Mining Journal.

EXPERIENCED GRADUATE metallurgists and metallurgical engineers required for large research and development organization in Northern Rhodesia. Duties relate to process metallurgy of copper, cobalt, lead, zinc and other base metals, with emphasis on ore concentration by flotation. Applicant must have minimum 5 years industrial experience. Total remuneration, $2,000 to $2,500 according to qualifications and experience, comprises basic salary, variable metal bonus and cost of living allowance. Generous pension and leave privileges. Housing provided at nominal rental. Free transportation to Northern Rhodesia for successful applicant and immediate family. Applications stating age, marital status, qualifications, experience record, availability, and accompanied by a recent photograph should be addressed to The Secretary, P.O. Box 172, Kitwe, Northern Rhodesia.

MINING OR Mechanical Engineer to assist in export sales of mining and earth moving equipment. Knowledge of foreign languages helpful. Location New York City. State salary desired. P-6644, Engineering & Mining Journal.

SENIOR RESEARCH Metallurgist: 5-8 years' research experience in concentrating and floating base metal ores. Some operating experience desirable. P-6623, Engineering & Mining Journal.

GENERAL SUPERINTENDENT, iron mining company operating in Lake Superior district. Experience open pit and underground operation, as well as beneficiation, required. Reply should state complete educational qualifications and operating experience as well as personal and family statistics. Salary open pending interview. P-6226, Engineering & Mining Journal.

WANTED: SENIOR Research Metallurgist under 45 and Chief Chemist under 40, by long established Mediterranean mine where living conditions are excellent. Three year contract, liberal vacations. Salary open. Submit record of education, experience, references, photograph optional. P-6621, Engineering & Mining Journal.

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WANTED: MECHANICAL draftsman. Permanent position. Experience in rolling stock for railways and mines desirable. Write to Differential Steel Car Company, Findlay, Ohio, giving age, qualifications, education, experience, etc., and interview will be arranged. P-7620, Engineering & Mining Journal.

VACANCY IN Department of Metallurgy, administrative and teaching. Doctor's degree is desirable. Prefer man between ages of 35-45, with teaching and/or industrial experience. Salary will depend on training and experience but will be a minimum of $6,000.00 for academic year. Consulting work is permitted. Location, Rocky Mountain area. P-6951, Engineering & Mining Journal.

DESIGN ENGINEER for plant layout and structural design work on mining and ore handling facilities. Permanent position in Pennsylvania with mining department of large steel company. Salary open. Applicants should be college graduates or equivalent with experience. P-7006, Engineering & Mining Journal.

MECHANICAL ENGINEER, college graduate, for design and office engineering position with a large mining organization. Location Eastern Pennsylvania. Salary open. Applicant must have practical experience with equipment used in the mining industry and should be a competent draftsman. P-7007, Engineering & Mining Journal.

GROWING MINING concern in southern West Virginia need graduate Mechanical Engineers with at least 5 years experience in design of mining equipment. Salary based on ability to produce. Reply P.O. Box 1169, Williamson, W. Va.

WANTED: UNDERGROUND Mine Supt. Preferably 35 to 45 years. Must be capable taking full charge and responsibility opening up, developing, and operating, for low cost extraction, from thin bedded (5' - 6' Width) deposits, involving (1) shrinking (2) top slicing, and (3) room and pillar systems. Must have up-to-date experience with modern mine plant mechanization. Should be technical graduate but will consider experience, energy and past operating record as foremost qualifications. Small but old and successful all mining company. Location Idaho, Wyoming, and Utah. Salary open. Will select by personal interview only. Write P-6811, Engineering & Mining Journal, giving full qualifications and salary desired. All Applications will be kept strictly confidential.

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For ore concentration plant in Colorado. Mechanical Degree preferred but not essential. Job requires ability to organize and supervise maintenance department with the help of three maintenance foremen. Should have 8 to 10 years experience in practical equipment maintenance and supervisory work. Salary open.

P6935 Engineering & Mining Journal
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POSITIONS WANTED

MINING ENGINEER. Broad experience Lake Superior District, eastern and western states, and abroad. Development, operation, and construction. Employed, married, 49. PW-7071, Engineering & Mining Journal.

MINING ENGINEER, graduate. Five years mining. 10-15 yrs. general engineering, mostly surveying. Competent all forms surveying, maps, computations. Want responsible position technical nature. Presently employed but available short notice. PW-6923, Engineering & Mining Journal.

METALLURGICAL ENGINEER, 32, married, B.S. Mineral Dressing. Experience open pit mining, ore dressing, sintering as Superintendent and Assistant Manager large operation. Good background in cost reduction, report preparation, maintenance and plant operation. Desires responsible position. PW-6801, Engineering & Mining Journal.

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MINING ENGINEER & Geologist, 39, experienced in management and research: open pit, placer, and underground mining, construction, light weight aggregates, prestressed concrete and explosives; excellent Spanish; seeks position, contract or salary, in production or exploration, U.S. or foreign. PW-6210, Engineering & Mining Journal.

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CW1319 — Engineering & Mining Journal
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Additional Opportunity Advertising on page 216

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1—21 Cu. Yd. Steel Hopper Bin
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1—9" x 36" Diamond Jaw Crusher
1—30" x 16" Pioneer Crushing Roll

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1—Dillon Double Drum Hoist, Rope Pull, 7,000 lbs., 500 FPM, with 100 HP Motor.
FS 6619 — Engineering & Mining Journal
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FS 7055, Engineering & Mining Journal
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330 W. 42nd St., New York 36, N.Y.

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W 6611 Engineering & Mining Journal
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Engineering & Mining Journal
330 West 42nd St., New York 36, N. Y.

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1—#12 Sweetland Filter Press, 36 leaves.

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1—9″ x 15″ Farrell
1—9″ x 16″ Universal
1—8″ x 24″ Rogers
1—9″ x 36″ Universal
1—11″ x 18″ Universal
1—24″ x 13″ Farrell

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1—New Morse Jetair 2 cell #7
1—Fagregan Single Cell
1—6 cell 18″ Stearns-Roger
1—6 cell Denver "Sub A" #18
1—6 cell Denver "Sub A" #21

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1—10 HP Vulcan #0 Single Drum
1—15 HP Morse New Single Drum
1—20 HP H&B Single Drum
1—22 HP Vulcan Single Drum #1½
1—30 HP Vulcan Single Drum
1—3 HP Vulcan Double Drum
1—3 HP Single Drum
2—52 HP Vulcan #4½ Single Drum
1—50 HP Fairbanks-Morse Single Drum
1—60 HP H&B Single Drum
1—60 HP Vulcan #23ELF Single Drum
4—100 HP Box Single Drum
1—112 HP Vulcan Single Drum
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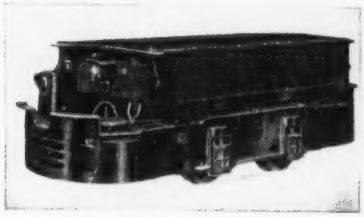

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1—2-2½ ton Whitcomb Battery, 24″ gauge
1—2½ ton Jeffrey battery or trolley, 36″ gauge
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1—3½ ton Mancha battery, 24″ gauge
1—4 ton Westinghouse battery, 24″ gauge
1—4 ton Ironton battery, 36″ gauge
2—7 ton General Electric permissible battery, 36″ gauge
1—7 ton Atlas battery, 36″ gauge
3—8 ton Ironton battery, 36″ gauge
2—8 ton General Electric battery, 36″ gauge
4—10 ton Atlas battery, 36″ gauge
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1—5 ton Jeffrey trolley, 36″ gauge
1—6 ton Goodman trolley, 36″ gauge
2—8 ton Goodman trolley, 36″ gauge

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1—4′ x 4′ Standard Ball Mill
2—6′ x 48″ Hardinge Conical Ball Mills with air swept equipment
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1—3′ x 8′ Marcy Rod Mill

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1—#045 Ainsworth 1 gram assay balance
1—Becker button balance, sensibility 1/50 mg.
1—Keller assay balance, inverted beam, sensibility 1/100 mg.
1—Smith & Thompson assay balance, sensibility .005 mg.
1—Thompson #7 button balance, sensibility 1/200 mg.
1—5000 oz. Fairbanks & Hutchinson bullion balance

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2—#8H 42 Jeffrey Aerodyne mine fans
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4—American Type HS New Blowers, 12000 CFM with 2 speed motors

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21—Deister "Plat-O" Tables

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1—5′ x 5′ Deco Conditioner with redwood tank
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18"	4	1/8"	1/32"	28 Oz.
20"	4	1/8"	1/32"	28 Oz.
20"	5	1/8"	1/32"	28 Oz.
24"	4	1/8"	1/32"	28 Oz.
24"	5	1/8"	1/32"	28 Oz.
26"	5	1/8"	1/32"	28 Oz.
30"	4	1/8"	1/16"	32 Oz.
30"	5	1/8"	1/16"	32 Oz.
30"	6	1/8"	1/16"	32 Oz.
36"	6	1/8"	1/16"	32 Oz.
42"	5	1/8"	1/16"	32 Oz.
48"	5	1/8"	1/16"	32 Oz.
48"	8	1/8"	1/16"	32 Oz.

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2	2100	G.E.	100	2300	360
2	1750	G.E.	100	2300	3600
1	750	G.E.	80	2300	450
1	600	G.E.	100	440	360
1	700	G.E.	80	2300	720
1	250	G.E.	100	2300	514
1	200	Whse.	80	440	1200
1	187	G.E.	80	440	720
1	150	G.E.	100	2200	900
1	150	G.E.	100	550	600
1	120	G.E.	80	550	450
2	135	G.E.	80	4000/2200	1200
3	125	El. Mchy.	100	4800/2400	900
1	125	G.E.	80	2200	900
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1	400	G.E.	I-K	2200	v514
1	400	G.E.	KT-412	2200	450
1	300	Whse.	CS-890	2300	1760
1	200	Whse.	CS-873-C	2200	1200
1	200	Al.Ch.	ARY	440	600
2	125	Al.Ch.	AR	2200	1750
1	125	Al.Ch.	AR	2300	514
1	125	C.W.	124-Q	440	450
2	100	Whse.	CS-643-C	440	1750
1	100	Al Ch.	AR	550	720
1	100	Whse.	CS-938	2200	514
1	100	F.M.	H-241	440	450
2	75	Al.Ch.	AR	2200	1705
1	78	G.E.	I-K	440	600
1	75	Al.Ch.	AR	2200	720

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1	1000	G.E.	514	600	2300
2	500	C.W.	720	575	2300/440
1	400	C.W.	1200	125/250	440/2300
2	250	Whse.	1200	125/250	2300
1	200	Ridgway	900	275	2300
2	200	Whse.	1200	125/250	440
1	155	G.E.	720	250	2300/440
2	150	Whse.	1200	250	2300
1	100	Al. Ch.	1200	125/250	4000/2300
1	100	Delco	1200	125/250	440/220
1	100	Ridgway	1200	275	4000/2300
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3	250	Packard	A	1	13,200-2200
3	150	Packard	A	1	2300-230/460
3	100	G.E.	H	1	33,000-2300
3	25	G.E	H	1	2400-120/240
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1	1200	G.E.	MT 38	2200	277
2	1000	Al.Ch.	ANY	2200	235
1	800	G.E.	MT	2200	440
1	700	Whse.	CW	2300	720
1	600	G.E.	MT 20	2300	360
1	500	Al.Ch.	ANY	2200	514
2	500	G.E.	I-16-M	2300	450
1	400	G.E.	MT 412	2200	440
1	250	Whse.	CW 937	440	1200
1	250	Al.Ch.	ANY	440	720
1	250	G.E.	MT 414	2200	300
1	125	Whse.	CW 870	2200	900
1	100	Whse.	CW 766	440	1200
1	100	F.M.	H 20 C	440	900
2	100	G.E.	I-15A-M	2300	514

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1***	2400	Whse.	Encl. (Rev.)	600
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4***	1200	Whse.	Encl. (Rev.)	600
4***	800	Whse.	Encl. (Rev.)	600
1	350	G.E.	CD-169-A	1150
1	200/250	El. Dy.	No. 23	400/1200
1	250	G.E.	MPC	325/975
1***	200	G.E.	MPC	500/1200
1	200	Whse.	Mill	300/1200
1	180	G.E.	MPC	400
1***	125	Whse.	SK-190	600
2	125	Whse.	SK-184	575/850
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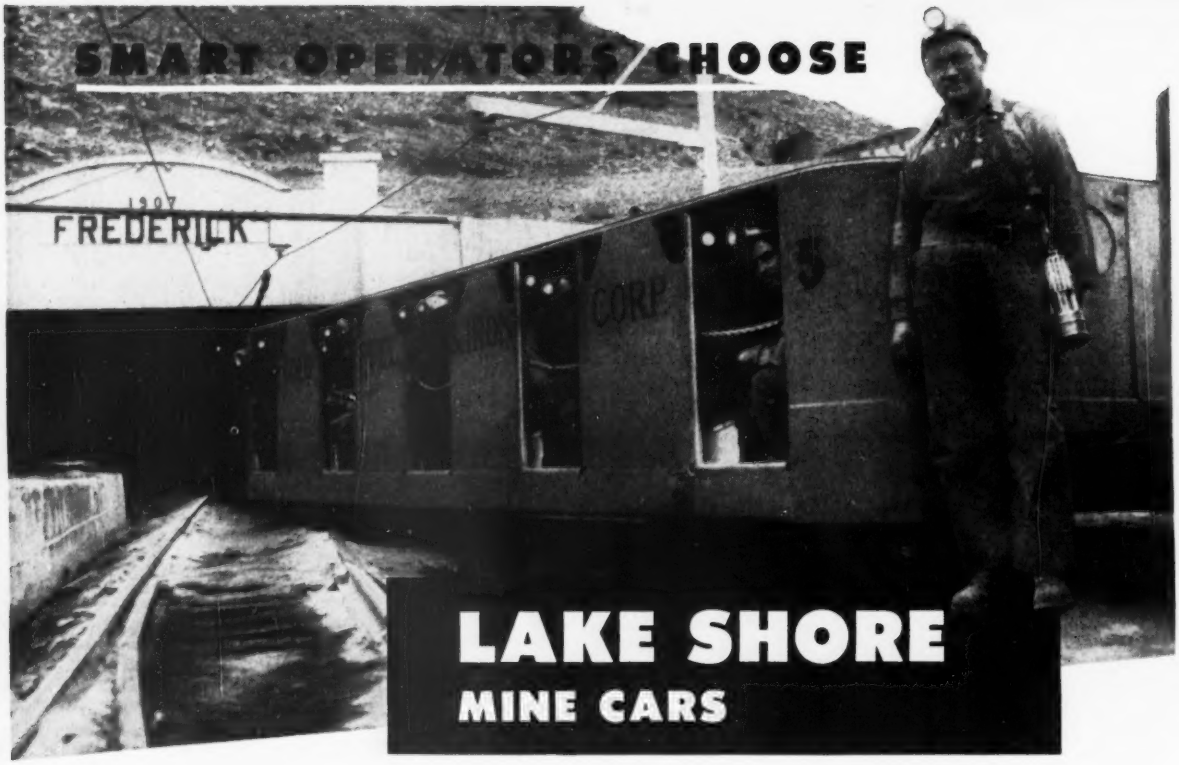

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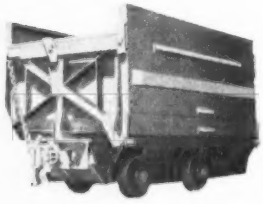

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MOVING A MOUNTAIN OF IRON

JUST before winter locks the Great Lakes, mountains of iron ore hit the docks for shipment and must be stockpiled in a hurry. To handle this rough, rush job for the Pittsburgh Dock Co., A. J. Baltes, Inc., of Norwalk, Ohio, uses a Caterpillar Diesel DW20 Tractor and No. 20 Scraper, push-loaded with a D8 track-type Tractor.

"I like the long-life performance of Caterpillar equipment," foreman K. H. Myers says. His earthmovers are on the go 10 hours a day handling this iron ore, hauling 24-ton loads a half mile, 7 or 8 trips an hour. "And I like their economy, too," he adds, for his DW20 wheel-type Tractor needs only about 45 gallons of fuel a day, *one-half* the consumption of another manufacturer's unit on the same job.

There's extra power and capacity built into the Caterpillar DW20 Tractor and No. 20 Scraper team. The 225-HP Diesel engine in the tractor is precisely balanced with the 20-cu.-yd. heaped capacity of the scraper to give sustained, long-haul, high-speed, low-cost service. The scraper, with a flat, double-bottomed bowl, is cable-operated for fast, sure loading and spreading. And this is a *safe* rig, too: anti-jackknife devices, large air-actuated brakes and power steering give operators complete control and cut down-time due to damaged equipment.

Your Caterpillar Dealer will be glad to demonstrate. And remember, only genuine Cat parts can give you the genuine Caterpillar quality that's built into every one of these big yellow machines.

CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS

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DIESEL ENGINES
TRACTORS • MOTOR GRADERS
EARTHMOVING EQUIPMENT

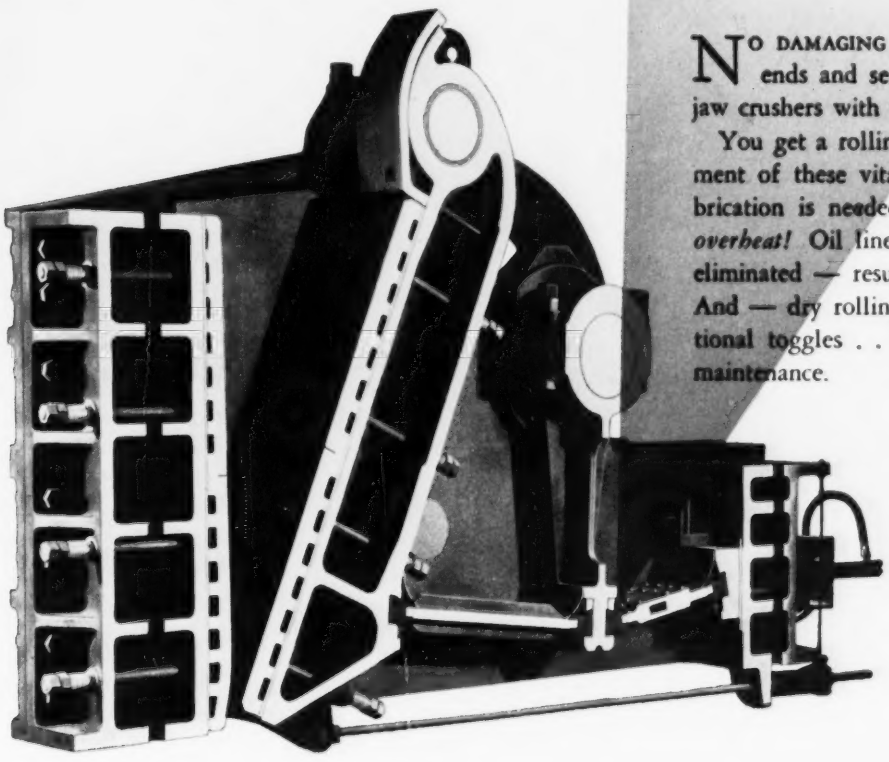
Dry Rolling Toggle

with Rockin' Chair Motion

A-1 Jaw Crushers

Reduces Maintenance and Downtime

No Lubrication Needed



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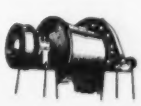

Grinding Mills

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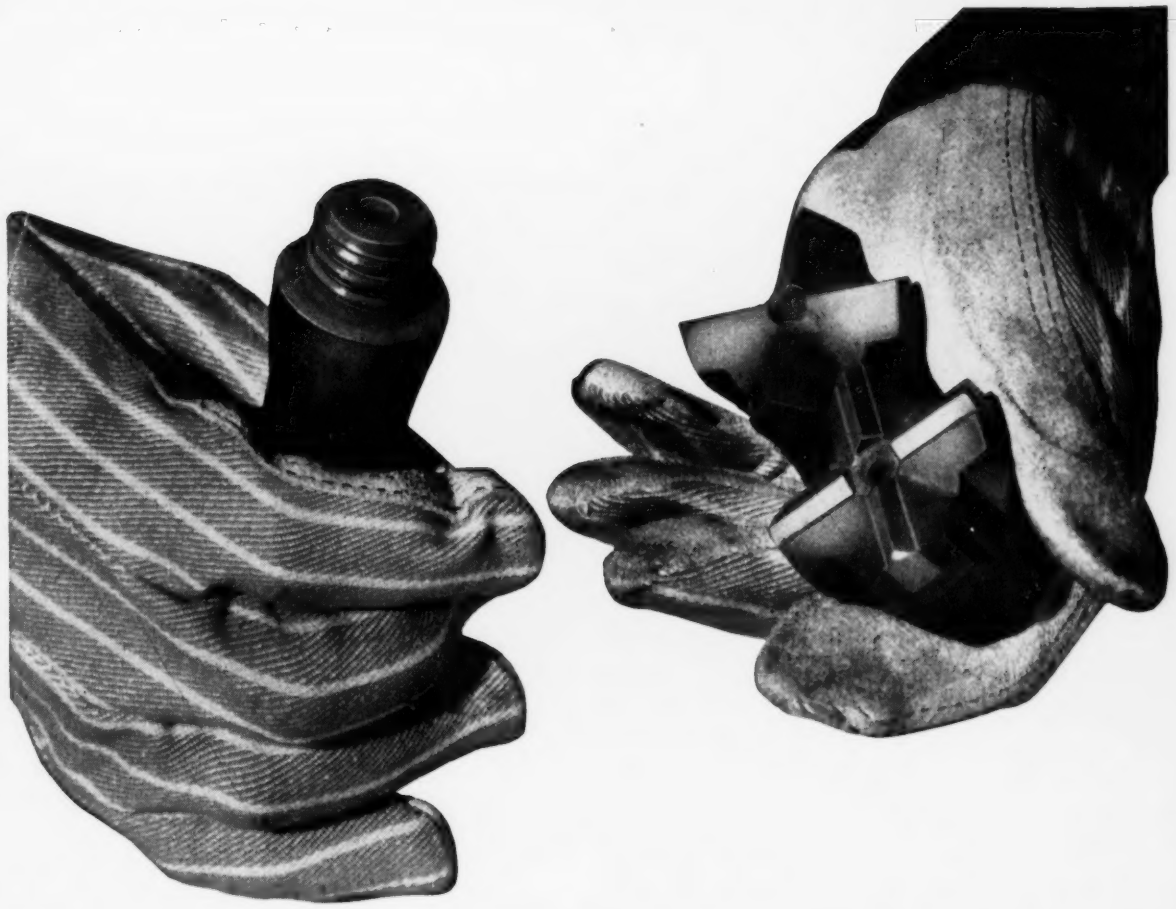

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